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### ACUTE MASTOIDITIS.<sup>1</sup>

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I HAVE been called upon on more than one occasion to operate for an acute mastoiditis, only to find a post-auricular œdema caused by a furuncle. Difficulty may be experienced in distinguishing between these two conditions, since both may produce swelling behind the ear with auricular displacement. The differential diagnosis is as a rule easy, although it is to be remembered that the two conditions may coexist. A history of otorrhœa following a recent fever, influenza, or cold in the head favours a mastoiditis, while a history of a sense of soreness in the ear on slight manipulation, such as

drying the ear after a wash or scratching the meatus, especially if there is a history of a previous furuncle, suggests a furunculosis. Hearing is not affected in furunculosis unless the meatus is completely blocked by swelling, whereas in mastoiditis it may be much reduced. Post-auricular œdema with displacement of the auricle due to a furuncle is common in adults and rare in children. In mastoiditis this incidence is reversed. Pain in furunculosis is constant—at first moderate and later almost unbearable. It is usually increased by movement of the jaw, as in chewing or yawning. Manipulation of the auricle is extremely painful, and this is a most valuable diagnostic sign. Lying on the ear is at times impossible in furunculosis. On the other hand, in a mastoiditis pain is not usually severe and is not influenced by movements of the jaw or by manipulation of the auricle. The character of the discharge is helpful. In furunculosis it occurs late in the disease, is scanty and

<sup>1</sup> Read at a meeting of the Queensland Branch of the British Medical Association on July 1, 1932.

never mucoid, whereas that from an *otitis media* is usually more profuse and muco-purulent. If the patient is instructed to inflate his ear by Valsalva's method, a bubbling or whistling sound would establish the presence of a perforation. Tenderness over the mastoid is absent in a furunculosis if the examiner directs the pressure so as to avoid movements of the auricle. Firm pressure in mastoiditis usually elicits deep-seated bone tenderness. Otoscopic examination in furunculosis will reveal a boil or swelling in the fibro-cartilaginous portion of the canal on the posterior or superior wall when there is oedema over the mastoid, and on the anterior wall when there is oedema in front of the tragus. In mastoiditis there is inflammation of the postero-superior lining membrane of the bony canal and there is a perforation of the drum membrane. An otoscopic examination should always be made, both to inspect the canal and to determine the condition of the drum, as without this inspection a positive diagnosis cannot be made. An anaesthetic may be required. In difficult cases, when a furunculosis is secondary to an acute *otitis media*, an X ray examination may help in the diagnosis, but the radiological must not outweigh the clinical findings. I have also seen a post-auricular oedema due to an abscess of the post-auricular gland following some infection of the scalp—impetigo or *pediculi capitis*.

I well remember being called in the early hours of the morning to operate on an acutely inflamed mastoid at the Brisbane Hospital, only to find this condition present. An otoscopic examination revealed a normal canal and drum membrane, and had this examination been done before I was called, I should have been saved the trip.

The diagnosis of an acute mastoiditis is simple when post-auricular oedema, mastoid tenderness, elevation of temperature and middle ear symptoms are present, but cases without oedema and with only slight or no mastoid tenderness and with even the absence of fever, are by no means infrequent. In fact, I have, during recent years, seen more of the atypical than of the classical cases.

An acute mastoiditis is usually secondary to an acute purulent *otitis media*. Now, during an attack of acute *otitis media*, what signs and symptoms would lead one to suspect involvement of the mastoid? In acute purulent *otitis media*, after myringotomy or rupture of the drum, the patient usually settles down and is comparatively comfortable, but may soon complain of deep-seated pain in the mastoid process, sometimes radiating over the side of the head. In other cases there may be no pain at all or only a vague feeling of discomfort in the side of the head. Insomnia may be present. Elevation of temperature of a moderate degree may persist, being present, as a rule, in the evening. It is a valuable symptom, but its absence must not be taken as evidence that the mastoid is not diseased. If the elevation of temperature continues in spite of proper treatment, it is a definite indication for mastoidectomy. Higher temperatures are usually common in children, but point to further complications in adults. A sudden rise of tempera-

ture with rigors suggests lateral sinus involvement, and a steady high temperature suggests meningitis.

Tenderness over the mastoid antrum or tip is often present in the early stages of an acute *otitis media* and is due to congestion of the lining membrane of the mastoid antrum and cells, and usually disappears in a few days under proper treatment. Both mastoids should be compared, but do not press underneath the tip, as this is painful in a healthy mastoid. The points of tenderness are usually situated over the antrum itself, that is, immediately behind the auricle, on a level with the meatus, at the tip, posterior to the tip and over the root of the zygoma in zygomatic mastoiditis. Should this initial tenderness persist with discharge from the ear, it is a definite indication for opening the mastoid. Increased or recurring mastoid tenderness, with or without rise of temperature, is due to an extension to further cells or to pus retained under pressure, and is a definite indication for surgical interference. The discharge may undergo quantitative changes which may lead one to suspect mastoid involvement. A sudden cessation of discharge with a rise of temperature due to pus retained under pressure, or a definite increase of discharge with coincident rise of temperature calls for surgical interference. A profuse discharge, on physical grounds, must of necessity come from the mastoid, and if it gradually becomes more purulent and persists unduly, calls for mastoidectomy, even in the absence of other signs. To wait for further symptoms to arise to give warning of danger is to court disaster. In these cases the general health suffers, the patient becomes gradually weaker, and there is loss of appetite and weight. Slight elevations of temperature in the evening may be noted. There is no pain or mastoid tenderness unless retention of pus takes place. Admittedly, after long delay, some patients do eventually recover, but not until much damage has been done to the delicate structures of the middle ear, with consequent impairment of hearing, and it is almost certain that these patients will drift into the chronic form of otorrhea—chronic mastoiditis.

Oedema over the mastoid is a late sign and is due to extension of the inflammatory process through the mastoid cortex to the periosteum and overlying soft tissues. The retro-auricular fold becomes obliterated; and should a cortical perforation take place, it forms a subperiosteal abscess. This is the type most frequently seen in children. In babies there is no mastoid process, but a well-formed antrum exists. The condition here is really an acute empyema of the antrum. Pus usually perforates the cortex, forming a subperiosteal abscess. A fluctuating swelling behind the ear may be the first sign to attract attention. When infection involves the posterior zygomatic cells, an abscess may develop beneath the temporal fascia and cause extensive swelling and tenderness anterior to the auricle and above the mandibular joint. It is possible to confuse this with a furuncular condition of the anterior meatal wall. Perforation

may take place into the diagastric groove on the inner aspect of the mastoid tip and produce what is known as Bezold's abscess. The neck below the mastoid tip becomes swollen and tender on pressure, and pus accumulates beneath the sternomastoid muscle. Bezold's abscess may simulate involvement of the glands in the posterior cervical triangle, but the presence of a middle ear suppuration and the fact that the finger cannot be placed underneath the mastoid tip will help in the diagnosis. I have seen perforation take place through the posterior meatal wall which could be mistaken for a furuncular condition, but the discharge is more profuse and a probe will reveal a perforation. Swelling of the postero-superior wall of the osseous meatus is due to periostitis in this region, which results from empyema of the antrum. This sagging or falling-in of the upper or posterior wall, even in the absence of other symptoms, is of grave significance and calls for immediate operation.

X rays may help in atypical cases. Both mastoids should be examined for comparison; they are usually symmetrical. Areas of cloudiness would indicate pus, and the outlines of the cells may be blurred. The position of the lateral sinus may also be revealed. There is a field for further study in this direction. As I pointed out before, too much reliance must not be placed on X ray findings.

#### Illustrative Cases.

CASE I.—A boy, aged five years, had measles and during the convalescent stage had earache in both ears. A double myringotomy was performed and was followed by a profuse mucopurulent discharge from both ears and an evening temperature ranging from 37.2° to 37.8° C. (99° to 100° F.). A few days later I was called in consultation. On examination I found there was a profuse discharge from both ears, but no mastoid tenderness, except perhaps a very slight amount at the tip on both sides on firm pressure. Hearing was dull. I diagnosed a mastoiditis, but the operation was not consented to. A fortnight later I was again called in. The discharge and temperature still persisted, and on examination there was some slight tenderness at the tip of both mastoids.

A double Schwartz mastoid operation was performed the following day. The mastoid was of the cellular type. Pus poured out when the cortex of each mastoid was opened and the cells were filled with granulation tissue and pus. His adenoids were removed at the same operation.

Recovery was uneventful. Early cessation of discharge from both ears took place, the drums healed and perfect hearing resulted.

In this case the character of the discharge, the mastoid tenderness and the continuance of fever were sufficient indications for a diagnosis of mastoiditis.

CASE II.—A girl, aged five years and ten months, had a feverish attack with a cold in the head, and some days later the mother noticed that the child's left ear was tender to touch, and she consulted me the same day. There was an acute rhinitis present and a bulging left drum. The temperature was 37.8° C. (100° F.). Myringotomy was immediately performed and this was later followed by a profuse discharge. The discharge was still profuse a fortnight later and preparations were made for a mastoid operation, but this was postponed, as the child developed scarlet fever which became noticeable on the morning appointed for operation. Three days later the temperature was normal and remained so for eight days, when it rose again to 38.3° C. (101° F.). The discharge

from the left ear was still profuse. There was no mastoid tenderness at any time. Tonsils and adenoids had been removed two years previously.

A Schwartz mastoid operation was performed. The mastoid was of a large pneumatic type, and all cells were plugged with granulation tissue and pus. Convalescence was rapid. The drum healed and good hearing resulted.

The sudden rise of temperature during an acute *otitis media*, particularly when the discharge is profuse, points to retention of pus or extension of infection and calls for mastoidectomy. One can safely wait a little longer in children, as the cortex is thin and the line of least resistance is external.

CASE III.—A girl, aged five years, was admitted to hospital suffering from nasal diphtheria. Ten days later the left ear commenced to discharge and two days after this the right ear commenced to discharge. There was no elevation of temperature and no pain at any time, but the discharge from both ears was somewhat profuse. Eleven days later the discharge was still profuse, when the temperature rose to 37.2° C. (99° F.) and stayed at that level for eight days and then rose suddenly to 38.9° C. (102° F.). There was neither mastoid tenderness nor edema at any time.

A double Schwartz mastoid operation was performed. The mastoid was of the cellular type. The cells were filled with swollen mucous membrane and pus. The tonsils and adenoids were removed at the same operation, as the patient was almost choking with them. Recovery was uneventful. The drum healed and normal hearing resulted.

The same comment might be made about this case as about Case II.

CASE IV.—A girl, aged eighteen months, was feverish and cross for two days and then the left ear began to discharge. The patient appeared comfortable and the temperature was normal. A fortnight later I was consulted on account of a swelling behind the left ear. Examination revealed swelling and edema behind the left ear, mucopus in the meatus, and a perforation in the posterior segment of the drum. The temperature was normal.

A Schwartz mastoid operation was performed. A subperiosteal abscess was found. Pus and granulations were present in the antrum and a few cells. Convalescence was rapid. The drum healed.

Subperiosteal abscess is common in children. It may be the first sign to attract attention.

CASE V.—A female patient, aged twenty-eight years, had a right acute *otitis media* following influenza. An early myringotomy had been done, and this was followed by a profuse discharge which persisted for seven weeks, with an occasional slight rise of temperature in the evening. There was no mastoid tenderness at any time. X ray examination revealed no abnormality. At this stage I was asked to see her. On examination there was a mucopurulent discharge from the right ear and a perforation in the posterior segment of the drum. She complained of vague discomfort about the right side of the head. There was no mastoid tenderness. I advised mastoidectomy. On the day before the operation there was some slight tenderness posterior to the mastoid tip, and a temperature of 37.2° C. (99° F.).

Heath's mastoid operation was performed. The mastoid was of the pneumatic type. The cells were broken down and bathed in pus and extending over the sinus groove. The sinus was uncovered and a perisinus abscess was present. The patient recovered and hearing was excellent.

The condition found showed that any further delay in operating would have been a grave danger to life. An earlier operation was indicated, as infection is more likely to extend towards the interior of the skull in adults.



CASE VI.—A male patient, aged about forty years, called me into the country. The history given me was that he had had influenza followed by a profuse discharge from the left ear, a slight evening rise of temperature to 37.2° C. (99° F.), but no mastoid tenderness or oedema. On the day before I saw him he had a sudden rise of temperature with headache. When I arrived, the patient was comatose. There was a profuse discharge from the left ear, with ptosis of the left lid and unequal pupils. Lumbar puncture revealed the cerebro-spinal fluid to be under increased pressure and very turbid. (Examination of this fluid later revealed streptococci.)

The condition was hopeless, but under light anaesthesia a Schwartz mastoid operation was performed. The mastoid was of the pneumatic type. The cortex was hard. All cells were broken down and filled with pus. No fistula was found in the roof of the antrum. The dura of the middle fossa was exposed by removing the tegmen. No extradural abscess or granulations on the dura were found, but pus was present on incision of the dura. The patient died the following day.

This case illustrates the danger of delay in dealing with adults, particularly in an influenzal condition.

CASE VII.—The patient was a male, aged sixty-three years. While visiting the previous patient (Case VI) I was asked to see this patient, who had had influenza a fortnight before, followed by pain, first in the left ear, and a few days later in the right. When I saw him there was a profuse discharge from both ears, slight evening rise of temperature, slight tenderness over both mastoid tips, but no oedema. I recommended a double mastoidectomy, but the operation was refused. Consent was obtained a few days later and he was sent up to me. His general condition was said to have improved. The temperature had never been higher than 37° C. (98.6° F.), but the discharge was still profuse. There was a postero-superior perforation of each drum. On firm pressure over the tip of both mastoids there was some mastoid tenderness. The temperature was normal.

A double Schwartz mastoid operation was performed. The mastoid was of the pneumatic type. The cortex was hard and the cells were broken down, including tip and zygomatic cells; all were bathed in pus. The lateral sinus was uncovered on the left side, as infected cells extended to the groove behind. The dura was exposed in the region of the *tegmen antri* on both sides. The dura was healthy in both situations. Recovery was uneventful, the drums healed and great improvement in hearing resulted.

Delay in operating would probably have been disastrous in this instance. Mastoid tenderness continuing is sufficient indication for operation.

CASE VIII.—A male patient, aged thirty-four years, gave a history that four days prior to seeing me he had been pushed into the baths and had fallen sideways into the water on to his left ear. There was no sudden pain, but he complained of a neuralgic pain about the left side of the face and of a full feeling in the ear. Twenty-four hours later he noticed what he thought to be water coming from the left ear. This afterwards became very profuse. He had at the time an acute coryza. When he was seen there was profuse discharge from the left ear and a perforation in the lower posterior segment of the drum. The temperature was 37.8° C. (100° F.). Hospital treatment was advised, but the patient did not go into hospital until the following day. The temperature was then 38.9° C. (102° F.) and there was some slight mastoid tenderness at the tip. Three days later the temperature had fallen to 37.2° C. (99° F.), but the discharge was still profuse and mastoid tenderness continued, and the patient felt uncomfortable.

A Schwartz mastoid operation was performed on the following day. A pneumatic type of mastoid was present. The cells were plugged with swollen mucous membrane and pus was present in the antrum. Convalescence was rapid. The perforation healed and good hearing resulted.

Persisting mastoid tenderness, elevation of temperature and profuse discharge are definite indications for operating.

CASE IX.—A girl, aged eighteen years, was said to have had "dengue" with a cold in the head a week previously and then complained of pain in both ears, with a temperature of 38.5° C. (101.4° F.). Her medical adviser referred her to me, reporting that her right drum was clear, but the left drum was injected and bulging and that there was mastoid tenderness with commencing redness and oedema and a definite nystagmus. When I saw her, the patient was complaining of severe earache in the left ear. On examination I found there was a nystagmus to the right and a bulging of the postero-superior quadrant of the left drum and marked tenderness over the mastoid tip. The temperature was 37.8° C. (100° F.). Myringotomy was performed the same day, but in the evening there was increased mastoid tenderness and the temperature rose to 38.7° C. (101.8° F.). There was a profuse discharge from the ear.

A Schwartz mastoid operation was performed. The mastoid was of the cellular type. The upper cells were filled with swollen, oedematous mucous membrane and a large tip cell filled with pus was discovered. The cells extended over the lateral sinus into the groove beyond. Convalescence was rapid. The drum healed and good hearing resulted.

Increasing mastoid tenderness and persisting high temperature, also vestibular irritation, as evidenced by the nystagmus, all call for operation.

CASE X.—A female patient, aged thirty-five years, had a severe cold in the head for a fortnight and then complained of a full feeling about the left cheek and of neuralgia of the left side of the face and supraorbital region, also of a full feeling in the left ear. Examination revealed an acute left maxillary sinusitis and very slight injection of the left drum. The left antrum was proopunctured and washed out. Two days later the patient had severe pain in the left ear. There was bulging of the drum in the postero-superior segment. Immediate myringotomy was performed. That same evening there was severe mastoid pain and a profuse serous discharge from the ear, and on the following morning there was marked tenderness all over the left mastoid and obliteration of the post-auricular fold. The temperature was 38.1° C. (100.6° F.).

A Schwartz mastoid operation was performed the next morning. The mastoid was of the large pneumatic type, the largest I have ever seen. Pus was present on opening the cortex and the cells were filled with swollen membrane, pus and serum. The cells extended over the sinus groove and well beyond into the occipital bone. There were large tip and post-meatal wall cells and cells also in the squamous and zygomatic regions. The ear ceased discharging in three days. The patient is still in hospital.

This was more of the classical type of case, but fulminating.

CASE XI.—A male patient, aged forty years, had submucous resection of a badly deflected septum performed, and seventeen days later complained of a stuffy left ear. The septum had healed, but there was still some crusting in the nose. On the following day he complained of having had earache during the night, and examination then revealed marked congestion and bullæ on the drum. The landmarks were all obscured. The temperature was 37.2° C. (99° F.). Myringotomy was performed and he slept fairly well that evening. The next day there was a profuse discharge from the ear. No mastoid tenderness was present. During the following eight days the discharge gradually decreased, the temperature was not above 37.2° C. (99° F.). On the eighth day he was discharged from hospital with a normal temperature. He then attended my surgery for daily treatment, the discharge being moderate only. X ray examination of the mastoids showed only a very slight haziness of the left mastoid cells compared with the right. Eight days later there was a sudden increase in the amount of discharge, but no rise



in temperature. No mastoid tenderness was present. A further X ray examination of the mastoid was made, but this revealed no change since the previous examination. As the discharge continued to be copious, an operation was recommended four days later.

A Schwartz mastoid operation was performed. Large cells of the pneumatic type were found. The cortex was hard. The cells were plugged with swollen mucous membrane. Pus was found in the tip cells and in the cells extending over the sinus groove. Recovery was uneventful. The drum healed and good hearing resulted.

*Otitis media* sometimes follows operations on the nose. Early profuse discharge settled down, but again became profuse indicating extension to further cells. There was no rise in temperature except in the early stages, and no mastoid tenderness was present at any time.

CASE XII.—A man, aged sixty-three years, was referred to me from the country on account of a double *otitis media* and marked deafness. The history was that he had had influenza a fortnight previously and a week later had complained of a fullness in the ears, a "dead" feeling in the head, but of no headache or earache. Three days later he woke up to find both ears discharging. The ears discharged profusely and there was marked deafness and tinnitus in both ears. Two days before I saw him the right ear had ceased discharging and examination revealed retraction of the right drum and a healed perforation in the posterior segment. The left meatus was found to be full of pus, with a perforation in the postero-superior segment of the drum. His hearing was very dull. The temperature was normal. After inflation of the right ear there was definite improvement in the hearing. The left ear was treated with wick drainage, but three weeks later was still discharging, though not profusely, and the perforation was now reduced to pinhole dimension and the drum appeared healthy. I enlarged the perforation for better drainage. There was no rise in temperature, mastoid tenderness or oedema at any time, but the patient complained of a vague feeling of discomfort over the left side of the head, and as the discharge continued, I advised operation.

A Schwartz mastoid operation was performed on the left ear. The mastoid was of the cellular type. The cortex was very hard. The mastoid cells were broken down and full of pus. A month later the perforation was healed, the hearing was good, but there was still some discharge from above and behind the aditus. The mastoid was reopened, the operation being converted into a Heath's. The discharge still continued from the upper posterior part of the mastoid, although the middle ear appeared to be perfectly normal. Later I found the trouble was due to some outlying cells in the upper posterior squamous region of the mastoid, and when these were opened up the patient made an uneventful recovery.

This man, in my opinion, had a double early mastoiditis. The right mastoid fortunately recovered, but the left did not. There was neither rise in temperature nor mastoid tenderness at any time, yet, bearing in mind the original profuse discharge, I intuitively felt he had an inflamed mastoid.

CASE XIII.—A male patient, aged forty-four years, had a mucopurulent nasal discharge for two weeks following influenza. This cleared up and a week later the patient developed a "fullness in the head and a feeling of malaise, and at times a dull ache in both ears, chiefly the left". About a week later the dull pain in the left ear became continuous. I was then consulted. The left drum was congested and bulging, and the right was injected down the hammer handle. There was no rise in temperature. Myringotomy was performed on the left ear. Although easier, the patient still felt ill. The following day the right drum was bulging and a myringotomy was performed on this ear, giving ease. There was a fairly copious discharge from both ears for a few days. The right

ceased to discharge with early healing of the drum, but the left continued to discharge in a moderate degree, the perforation rapidly closing. The left ear ceased draining and severe neuralgic pains developed on that side of the head. Examination showed the perforation to be in the upper posterior segment and to be too small for adequate drainage. It had a "nipple-like" appearance, with pinhole perforation on the summit, from which there was very slight discharge. The rest of the drum appeared healthy. I enlarged the perforation and the patient obtained relief with slight increase of the discharge. Over a period of six weeks this "nipple-like" appearance recurred and had to be incised four times. The discharge was so scanty that a Siegel's speculum was used to withdraw it through the perforation. X ray examination was of little assistance. To quote the patient's own words: "Throughout it all my head felt full and ached continuously, but not severely, except when the left ear ceased to drain." There was no rise in temperature and no mastoid tenderness was present at any time.

A Schwartz mastoid operation was performed. The mastoid was of the cellular type. The cells over the antrum were filled with granulations and pus, and pus was present in the antrum. Twenty-four hours after operation the patient had lost all his head symptoms. He made an uneventful recovery. The drum healed and good hearing resulted.

The persistence of nipple-like perforation in the posterior quadrant, when the rest of the drum is normal, points to mastoid infection.

CASE XIV.—A male patient, aged thirty-nine years, eight weeks prior to admission to hospital, had had influenza followed by a profuse discharge from the left ear. He had not complained of earache or deafness, and presented himself at hospital for relief of a severe left-sided headache. He was recommended for admission for operation and treatment. Ten days later he was prepared for operation on the mastoid, but this was not done, as the discharge had practically ceased and he was not complaining. A few days later he was discharged from hospital. I saw him for the first time ten days later, when he returned to the hospital complaining of pain and swelling below the lobe of the left ear. On examination there was a fluctuating swelling below the lobe of the ear, in the angle in front of the mastoid. Otoscopic examination revealed a somewhat sclerosed drum. There was no perforation, no discharge and no mastoid tenderness. The abscess was incised and pus was evacuated, and in a few days healing was complete. He was then discharged from hospital. Seventeen days later he returned, complaining of pain and swelling below the lobe of the ear. Examination revealed an abscess, which was incised, but this time a probe revealed a fistula into the mastoid.

A Schwartz mastoid operation was performed. The mastoid was of the cellular type. The cells were plugged with granulation tissue and a large tip cell full of pus communicated with the abscess in the neck through an erosion in the diaphragm groove. Some little trouble was experienced with the wound afterwards, but the patient is now doing quite well.

This is the condition known as Bezold's abscess.

#### Prevention.

As an acute mastoiditis is secondary to an acute *otitis media*, our aim should be to prevent the latter, but should an *otitis media* unfortunately occur, then its careful management will minimize the risk of a complicating mastoiditis. The occurrence of middle ear suppuration is commoner in children, as they are more susceptible to the exanthemata and to catarrhal conditions due to the presence of adenoids. In adults middle ear suppuration is particularly apt to complicate influenza or an acute catarrhal condition. The importance of adenoids as a predisposing factor cannot be over-estimated. In the

children that I have seen suffering from mastoiditis, all but one had adenoids. You are all familiar with the symptoms of adenoids, namely, facial expression with open mouth, irregular teeth, high arched palate, skeletal deformities, frequent colds, sniffles, listlessness, deafness or earache, but the dullness of hearing may be the only symptom complained of, particularly when the adenoid is located on the side of the nasopharynx or when there is a roomy nasopharynx. Parents may state that the child is inattentive or perhaps has just occasional slight earache, and no other symptoms may be present, yet an otoscopic examination reveals a retracted drum, frequently chronically congested. These patients almost certainly have adenoids. Digital examination in young children and posterior rhinoscopy in older children confirm the diagnosis. Personally I prefer an anæsthetic for the digital examination, as the curette is sure to be needed. This operation itself will usually restore the drum to normal, but a course of politizerization also is sometimes necessary. Any abnormal condition in the nose associated with catarrh calls for treatment. Patients should be discouraged from blowing the nose vigorously during an acute rhinitis or an acute suppurative sinusitis, but should hawk any discharge into the nasopharynx and should not hold the nose with the handkerchief, but blow gently into one and then wipe the nose. Violent efforts to clear the nose while swimming and improper douching of the nose sometimes lead to an acute *otitis media*. The observance of these rules will prevent the forcing of any septic material into the Eustachian orifices. In scarlet fever, measles or pneumonia a secondary rise of temperature when the initial fever is subsiding calls for an otoscopic examination. You will frequently save yourself hours of anxiety by the observance of this little rule. Prompt incision of the drum, as soon as there is any evidence of bulging, will lessen the likelihood of mastoid complication. The ear should be immediately examined if there are any complaints of fullness, deafness or earache during an attack of influenza or any other upper respiratory infection; and treatment should be promptly instituted and early myringotomy performed, if indicated. In one case cited this evening the *otitis media* followed traumatic rupture of the drum and went on to an acute mastoiditis. In babies *otitis media* is frequently associated with teething.

#### Treatment.

To avoid the danger of complications, all patients seen at the commencement of an acute *otitis media* should be placed in bed and kept there until the acute symptoms have subsided and the temperature is again normal. A light diet should be ordered and a suitable purgative, preferably calomel followed by a saline. There is an acute infective process going on in the tympanum, and rest, with freedom from exertion, exercises a favourable influence in this condition, as in any acute infective condition in other parts of the body. Pain calls for treatment and, if not severe, is frequently

relieved by douching the meatus with a warm lotion, such as biniodide of mercury, one in 5,000, or carbolic acid, one in 200. The instillation of 10% glycerine and carbolic acid drops is also helpful, as the carbolic acid has a mild anæsthetic effect and the glycerine a hygroscopic action. These simple methods have the additional advantage of preparing the field for operation, should operation later become necessary. The application of a hot bag to the ear is much appreciated, and "Emperin Compound" is helpful. Pain is a valuable guide and should not be masked by the use of strong anæsthetic drops or the administration of morphine. Pain is due to mechanical tension, and if this tension is increasing, pain becomes severe and the drum-head should be promptly incised. The drum should be carefully watched, and should there be very acute congestion or signs of bulging in whole or part, myringotomy is indicated. The primary and urgent need in almost every case of *otitis media* is free incision of the drum. To wait until spontaneous rupture takes place causes unnecessary suffering, does more damage to the drum, with risk of loss of hearing and the possibility of mastoid and intracranial complications. A free incision of the drum relieves the pressure, establishes drainage, and the wound heals with but little damage and no scar tissue.

Incision of the drum membrane is done for the purpose of evacuating the purulent contents of the tympanum and the relief of pain, or for enlarging perforations which already exist but which are too small for adequate drainage. The field for operation should be prepared as indicated previously, and a piece of sterile wick should be placed in the meatus. A general anæsthetic should be given; ethyl chloride will suffice. Just before the anæsthetic is administered the patient's head should be placed in a suitable position. The largest sized speculum that can be inserted into the meatus should be chosen; the headlight should be adjusted and a suitable myringotomy knife—a small curved bistoury—placed at an obtuse angle to the handle will be found the most useful; angled ear forceps and two or three strips of half-inch selvedged gauze should be at hand. The incision is usually made in the posterior segment and is carried from the lower border to the upper border. In performing this small operation the normal slant of the drum should be kept in mind. The drum is obliquely placed, forming obtuse angles with the roof and posterior wall and acute angles with the floor and anterior wall. If the incision is made from above downwards, the knife will quickly cut out, making only a small incision, unless the point of the knife is advanced inwards as well as downwards. In trying to do this delicate manœuvre, the point of the knife may injure the inner tympanic wall and has been known to engage the stapes and drag it from the oval window or rupture its annular ligament. In incising from below upwards, the incision is made while withdrawing the knife, this danger thus being obviated. In some cases, immediately after incision pus and

air escape under pressure, while in others serum and blood only appear, but in the latter case otorrhoea usually sets in within twenty-four hours. As soon as the drum is incised, the meatus should be lightly packed with a sterile gauze wick and a piece of sterile wool should be placed in the concha. The wick should be carried down to the drum. This procedure prevents clots from forming in the meatus and obstructing drainage. The wick is removed half an hour later and a fresh one is inserted and then changed every twelve or twenty-four hours, according to the amount of discharge. Some prefer frequent irrigation, but I have found the wick treatment valuable, and feel sure it has shortened many an attack. It certainly prevents the irritation of the meatus and acute eczematous conditions frequently seen, particularly in children. If, in spite of proper treatment, the discharge persists for more than four weeks, the advisability of opening the mastoid should be seriously considered, for, as long as discharge is present, one cannot tell when or how it will end.

When signs of mastoid inflammation appear and the patient is not already under treatment, he should be sent to bed and treated in the manner described for *otitis media*. The drum should be inspected and, if drainage is insufficient, the perforation should be enlarged. When once a mastoiditis has developed, the condition is rarely aborted and operation on the mastoid usually becomes necessary. If operation is delayed too long, it may be a question of not merely opening the mastoid, but of saving the patient's life. Operation should not be delayed longer than a few days in adults, as the cortex of the mastoid is hard and the line of least resistance is towards the interior of the skull. In children we can safely wait longer as the cortex is thin and the line of least resistance is external. In doubtful cases it is safer to operate and explore. A "wait and see" policy is dangerous.

#### THE MODE OF ACTION OF THE DIATHERMY CURRENT.

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DIATHERMY is a form of thermotherapy in which all the beneficial effects are produced by the action of heat, the heat being generated by the Joule effect of currents of high frequency passing through the tissues. This heat differs only from ordinary heat in its mode of production and its distribution. All forms of current generate ohmic heat in passing through a resistance and therefore in passing through living tissue. Currents of low periodicity cause such marked motor and sensory stimulation that it is impossible to pass currents of sufficient intensity to make this heat production a noticeable feature. If, however, the periodicity is raised to a very high level, at a frequency of about ten kilo-

cycles and thereafter, all stimulation ceases, and the only limit to the passage of high intensities is the heat produced. This heat appears to be the only physical result. In practice diathermy currents range from 500 to 3,000 kilocycles per second, with an average somewhere in the region of 1,000, that is 1,000,000 oscillations per second. The absence of stimulation depends upon the extremely rapid reversals of polarity whereby a potential chemical change occurring on one wave is cancelled by the succeeding reversed wave before stimulation can occur. It is of interest to note that, if the current be rectified so that no change of polarity takes place, stimulation is seen in spite of the high frequency.

Attempts have been made to ascribe the benefits of diathermy treatment to vague electrical effects explained as cellular massage or ionic bombardment, but such picturesque theories can neither be proven nor refuted. Heat production and its well known sequelae explain all the facts in a reasonably comprehensive manner, and it seems unnecessary at the present juncture to look for vague mysteries which merely serve to confound common sense. The doctrine of specific effects for specific frequencies in diathermy finds little or no support in the literature. Such variations as attend changes of frequency are, as far as we know at present, purely physical and in no wise bound up with specific biological effects.

The diathermy current is thus merely the heating agent and in a certain sense the treatment in its essentials is not electrical at all. We use the diathermy current because it is a means whereby we can apply penetrating heat internally, and electrical considerations hold our attention only in so far as they govern the production and distribution of this heat. The treatment is indicated where heat and its results are considered beneficial, the converse being also true. If this fact be borne in mind there will be much less heart-burning than if we apply it indiscriminately to widely differing pathological conditions.

A consideration of the mode of action of diathermy will accordingly involve a discussion, first, of the physical laws whereby the heat is produced and distributed or in any way modified, and, secondly, of those biological reactions consequent upon the heat and which in their totality constitute the therapeutic effect.

#### PHYSICAL CONSIDERATIONS.

From a physical point of view, three laws govern the production and distribution of heat in electrical circuits and apply with modifications to all forms of current. They may be briefly summarized as follows:

1. Ohm's law, which states the relation between voltage, ampère and resistance, and is embodied in the equation  $E = IR$ , where  $E$  is the electro-motive force,  $I$  the current and  $R$  the resistance.

2. Kirschhoff's law, which deals with the distribution of current in branched circuits. From our present point of view, we need only mention the deduction from this principle which states that if two paths in parallel are available to the current,



the major portion of the current will pass *via* the lesser resistance.

3. Joule's law, which concerns itself with the relations of the heat produced to the electrical constants in the circuit. The following equation states the principle:  $H = 0.24 I^2 RT$  calories, where  $H$  is the total heat in calories produced by a current of  $I$  ampères flowing through a resistance of  $R$  ohms for  $T$  seconds.

It can be shown that the diathermy current in organic tissue obeys all three laws with some modifications due to the complexity of the current and also of the conductor.

That Ohm's law should be obeyed would seem almost axiomatic, but we see it repeatedly stated that the diathermy current runs into thousands of volts as applied therapeutically, and much discussion has taken place as to the relative merits of high and low voltage diathermy machines. The effective resistance of the human body has been accurately measured for high frequency currents, and the maximum resistances are of the order of 200 ohms.<sup>(1)</sup> The current passed is of the order of one or two ampères, and a brief calculation with Ohm's formula will show that the maximum effective voltage must be of the order of 200 to 400 volts if the law is to be obeyed. On the other hand, a high voltage diathermy machine will spark across quite a large air gap, proving the existence of considerable potential differences. The crucial fact which reconciles these two apparently conflicting phenomena is that the voltage impressed on the patient collapses to a low value consistent with Ohm's law as soon as any significant current value is taken out of the machine. Sparking across an air gap involves no significant transfer of current and the voltage is therefore in this case maintained. A high voltage machine thus seems to possess no special advantages, and in addition has the defect that, should the patient accidentally break contact with the electrodes, very smart arcing will at once occur.

It has also been claimed that the diathermy current passes more directly through all tissues irrespective of their electrical resistance and therefore of Kirschhoff's law of branched circuits. That high frequency currents take the path of least resistance can be demonstrated by the following simple experiment.

**Experiment I.**—Take two small beakers of about fifty cubic centimetres capacity. Insert two electrodes in each on opposite sides and connect up in parallel with a diathermy machine. Fill one with tap water (high resistance) and one with normal saline solution (low resistance). Pass a current of 1,000 milliampères. In five minutes the temperature of the tap water will rise only 1° C., whilst that of the saline solution rises 25° C.

Since the heat produced is proportional to  $I^2 R$  and the resistance of the saline solution is the smaller of the two, it follows that by far the major portion of the current passes through the low resistance.

The heat in the solutions in this experiment is, of course, produced by the Joule effect in the same manner as it is produced in therapeutic applications, and is represented in calories by the formula  $0.24 I^2 RT$ . The current as read on the diathermy

meter is therefore not even a comparative indication of the actual amount of heat generated in the absence of a knowledge of the resistance. A modification of Experiment I will demonstrate this immediately.

**Experiment II.**—Take the two beakers of saline solution and tap water as in Experiment I, but connect in series with the machine so that the same current must pass through both. Pass a current of 500 milliampères. In about two minutes the temperature of the tap water (high resistance) will rise 83° C. and boil, whilst that of the saline solution (low resistance) will rise only 4° C., a reversal of our previous effect.

The same current passes through each cell and the heat produced varies as the resistance of the solution.

From these two experiments we may conclude that a high resistance in series produces more heat and in parallel less heat than a low resistance, a result which will equally apply to constant currents. The clinical significance is fairly obvious. In treating a limb by through-and-through diathermy with lateral plates the skin is a series high resistance and will heat up more than the contents of the limb. The bone in the limb, on the other hand, is in parallel, as the current has other alternative paths available. Being of high resistance, it will not directly become hot to any appreciable extent, though it may absorb heat from its surroundings. The following table from Grover<sup>(2)</sup> gives the approximate relative resistances of the various tissues of the body.

Bone .....	100	Intestines .....	30
Fat .....	90	Glands .....	25
Skin, cold and dry ..	80	Muscles .....	20
Skin, warm and moist	50	Liver .....	10
Brain .....	50	Recent inflammatory	
Scar tissue .....	40	exudates .....	5
Liver, sclerosed ....	40	Blood .....	2
Lung, normal .....	30	Serum .....	1

It is well to note that the heat produced varies as the square of the current passing, for this explains why slight variations of current make great differences to the heat experienced by the patient.

If parallel plates of area  $A$  square centimetres be applied to a part of thickness  $L$  centimetres composed of tissues of specific resistance  $w$ , then the resistance of the whole

part equals  $\frac{wL}{A}$ . Substituting this value for  $R$  in Joule's formula, where  $H$  represents the total heat generated in  $T$  seconds,

$$H = \frac{0.24 I^2 wLT}{A} \text{ calories.}$$

Now if  $h$  equal the calories produced in the part per cubic centimetre per second, then

$$h = \frac{H}{VT} \text{ calories per second where } V \text{ is the volume of the tissue.}$$

$$\begin{aligned} &= \frac{H}{LAT} \\ &= \frac{0.24 I^2 wLT}{A \cdot LAT} \text{ substituting for } H \\ &= \frac{0.24 w I^2}{A^2} \end{aligned}$$

$$\begin{aligned} &= 0.24 w \left( \frac{I}{A} \right)^2 \\ &= kE^2 \text{ where } k \text{ is a constant and } E \text{ is the energy density of the current per square centimetre of the cross section of the part.} \end{aligned}$$

This simple algebra indicates that the greatest heat production will take place in those areas where the energy density of the current per square centimetre is greatest and that it will vary directly as the square of that value. For example, if a current is passing from hand to hand, we may designate the cross section of wrist, forearm and shoulder, A, 2A and 4A respectively. The heat produced per cubic centimetre in these parts would be as 16, 4 and 1, in the same order, so that the local temperature would be highest in the wrists. The influence of the energy density distribution upon the development of heat is well shown for inert systems by the use of a stiff conducting jelly containing a temperature indicator which undergoes a colour change. Such a substance is Pariseau's jelly.<sup>1</sup> Various shaped blocks can be cut, and with the use of differently shaped electrodes the influence of both these factors on the distribution of the heat can be readily ascertained. In every case, without exception, heat indication will first and chiefly be found at the location of greatest energy density. If the substance be cut in the form of a large rectangular block and small electrodes be applied to two parallel sides, the colour change will first be seen immediately under the electrodes. For here, owing to the slight dispersion of the lines of current flow in the homogeneous matrix, is the location of maximum current density. The substance thus heats up from without inwards, contrary to the usual belief.

Bettmann and Crohn,<sup>(3)</sup> after working with various substances, emphatically state that in their inert preparations under the above conditions they were never able to produce the first and earliest evidence of heat anywhere but immediately under the electrodes. The well known experiment of coagulating albumin by the diathermy current midway between the electrodes is usually due to excessive radiation of heat at the metal electrodes. Heat thus first accumulates in the centre. If this radiation be prevented, the phenomenon does not occur.

Clinically the skin and subcutaneous tissues present a higher resistance than the underlying contents and are, moreover, in series connexion with these contents in the usual form of treatment. The superficial coverings of a part will therefore tend to develop more heat on these counts in addition.

Binger and Christie,<sup>(4)</sup> working with anæsthetized dogs and measuring the deep temperature with thermocouples, found that there was a normal temperature gradient for the tissues of the body. This gradient fell from without inwards to a degree shown by the following table, taken from their article.

Rectum .....	35.57° C.
Lung .....	35.44° C.
Muscle .....	35.14° C.
Subcutaneous .....	34.27° C.
Skin .....	33.65° C.

On repetition of their measurements in the path of a diathermy current of clinical magnitude, the gradient was definitely reversed, the skin and subcutaneous tissues being always the hottest, in some cases by as much as 10° C.

Whilst the results of experiments upon inert systems or anæsthetized animals cannot be applied indiscriminately to human beings, it may fairly be concluded that a part under diathermy treatment becomes warm from without inwards and that the highest temperature attained lies in the skin and subcutaneous tissues. This fact will become more evident when we consider the cooling effect of the circulation. Anticipating our argument a little, we can here see why a gradual increase of intensity is desirable, for otherwise heat accumulates in the superficial sensory layers and evokes discomfort before deep penetration occurs. With a slow increase circulatory responses develop *pari passu* and limit this superficial accumulation. It is also obvious why tissues with much subcutaneous fat are more liable to superficial burns, since the poor blood supply limits the cooling effect of any vascular changes.

#### The Effects of High Frequency upon the Distribution of the Heat.

We have seen that the high frequency current is used in diathermy to avoid stimulatory effects upon the patient, but high frequency currents have certain characteristics which seriously modify the production and distribution of the heat. Beginning with a fundamental fact, an alternating current will pass across a condenser which constitutes an absolute block to a current of constant potential. The material between the plates of the condenser (the dielectric) transmits no electrons, and therefore no ohmic heat is formed in it. The current crosses such a condenser with an ease which varies inversely as the distance between the plates and directly as the frequency of the current, the area of the plates and the nature (dielectric constant) of the dielectric. To high frequency currents as used in diathermy such a condenser of high capacity presents no impediment and certainly far less than even a small resistance. If we now shunt a non-inductive resistance *r* across a condenser *C*, we have what is known as a leaky condenser (Figure I, a), and current passing has the choice of two routes, by *r* or by *C*. It will tend to divide between the two, more current going through *C* at high frequencies, less at low frequencies. A current of constant potential must all go through *r*, a current of infinite frequency (to which the diathermy current approximates in its higher ranges) will all go through *C*. Viewing the same fact from another angle, with a current of a given frequency, increasing values of *r* tend to divert more and more current

<sup>1</sup> Pariseau's jelly: There are two solutions, A and B.

A = mercuric iodide 10 grammes, potassium iodide 10 grammes, water 500 cubic centimetres.

B = silver nitrate 12.5 grammes, water 500 cubic centimetres.

Pour equal quantities together. Take 20 to 30 grammes of Merck's agar-agar. Let soak in solution overnight and bring to boil next morning. Pour out and let cool in moulds. Be careful not to agitate or it will not set. This is a yellow jelly which changes to a pink or brick red when heated. The colour change is reversible.

via C. Let it be noted that in passage through C no heat is formed.

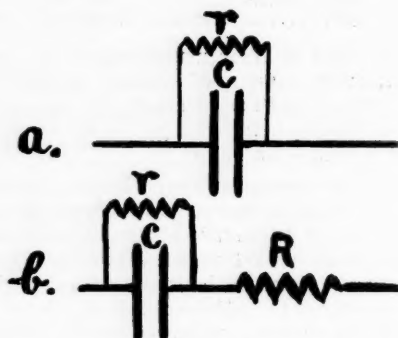


FIGURE I.

Taking a hypothetical circuit as in Figure I, b, representing a leaky condenser with a non-inductive resistance in series. To a constant current  $I$  the resistance is  $R + r$ , as no current can go through  $C$ , and the heat produced is proportional to  $I^2(R + r)$ . To a current of infinite frequency, as none goes through  $r$ , the resistance is  $R$ , and the heat accordingly proportional to  $I^2R$ , which is obviously less than in the first case. We thus see that even in such a simple system the heat produced per unit current becomes less with increasing frequency—a fact which accords with clinical experience. It becomes less, obviously because the current avoids passing along the resistance  $r$  with the production of ohmic heat, by taking the path  $C$ , and in  $C$ , as we have seen, no ohmic heat is formed. The former method is termed passing by conductance and the latter by capacitance. The current in the latter case is called a capacity or wattless current. The dielectric may be an absolute insulator, such as glass. On the other hand, it may be a conducting substance of high resistance, in which case part of the current passes from plate to plate by capacitance without heat formation and part may be directly conducted across the dielectric in ohmic fashion. This state of affairs is electrically represented also by Figure I, a.

The important point to note is that these capacitance effects furnish means whereby a diathermy current may pass a thin layer of high resisting tissue, in part or in whole, without the formation of ohmic heat in that layer. Such a conception leads us to consider a high resisting fascial layer in the body athwart the current stream as the dielectric of a condenser of which the proximate layers of tissue or fluid on each side constitute the plates, and to look upon a limb as a succession of such leaky condensers in series with resistances.<sup>(5)</sup> For instance, it is probable that the diathermy current in large part crosses the resistant epidermis by a capacitance mechanism without the formation of heat. The epidermis is a high resistance in series, in the usual plate electrode method, and that it does not become vastly hotter is due to the fact

that portion of the current at least passes in the above manner.

It follows from the above that quite large quantities of resistance are cut out by these capacitance effects, the proportion increasing as the frequency of the current rises. This explains the fact that with increasing frequency the resistance of the part decreases. Naturally the heat production per unit current suffers a corresponding decline. A further point to emphasize is that current passing one fascial layer by capacitance is not prevented from passing succeeding portions of tissue by conductance or even of passing one and the same layer partly by each method. An experiment will perhaps illustrate.

**Experiment III.**—Take a flat dispensing bottle (see Figure II, a), about two to three centimetres thick, and apply flat electrodes to the two sides, claspings on with elastic bands. Bore two holes in a cork for a thermometer and a thin, long tube, allowing for expansion of the bottle contents. Fill with tap water, cork, connect both electrodes with a diathermy machine and plunge the whole bottle in a bath of transformer oil. This oil is a perfect insulating medium and will prevent sparking between the electrodes and the glass.

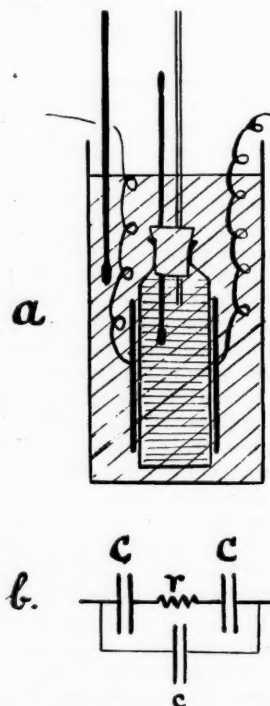


FIGURE II.

Turn on the current and pass about 400 milliamperes through the bottle.

With a 60 cubic centimetre bottle immersed in about 350 cubic centimetres of oil, the temperature of the contents of the bottle rose  $42^{\circ}\text{C}$ . above room temperature and that of the oil bath (by conduction from the bottle)  $25^{\circ}\text{C}$ . in twenty-five minutes.

Quite evidently the water lying inside an insulating container of glass becomes heated by the current.

Control experiments were carried out to insure that the heat is formed by the ohmic resistance of the water and not by dielectric strain in the glass walls.



In this experiment each glass wall of the bottle forms the dielectric of a condenser of which the proximate layer of tap water is one plate and the electrode the other. The electrical circuit may be depicted by the diagram (Figure II, b) in which  $CO$  represent the capacities at the glass walls,  $r$  the ohmic resistance of the water, and  $c$  the electrostatic capacity between the two electrodes with the whole bottle and its contents as the dielectric. Such wattless current as passes *via* this mechanism  $c$  will not, of course, heat the solution. All the heat comes from the current passing the resistance  $r$  of the water after passing the glass walls in wattless fashion.

This experiment may be considered to represent a cell in the path of the diathermy current. It has been estimated that the wall of a red blood corpuscle consists of a layer of carbon atoms from twenty to thirty deep and that the substance of the wall has a specific resistance of one million ohms—a value five thousand times greater than that of the cell contents which are rated at two hundred ohms.<sup>(5)</sup> Figure III may be considered to be a cell in the path of the diathermy current, the circumference being the cell wall.  $CC$  and  $RR$

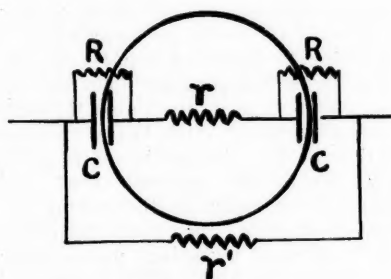


FIGURE III.

are the capacities and resistances of this wall which acts as a leaky condenser;  $r$  is the intracellular resistance and  $r'$  the resistance of the alternative path through the extracellular fluids. It is reasonable to assume that  $r$  and  $r'$  are at least of comparable magnitudes whilst we have seen that  $R$  is enormous compared with either of them. To a plain galvanic current the resistance of the cell is  $2R + r$ , a relatively enormous quantity beside  $r'$ . Thus in accordance with Kirschhoff's law practically all the current will pass *via* the extracellular route. To a diathermy current of high frequency the resistances  $RR$  will be largely by-passed *via* the capacitances  $CC$  without heating or straining the cell membrane. Thus the effective resistance of the cell to the diathermy current approximates to  $r$  which is comparable to  $r'$ . Consequently some at least of the current will pass through the cell contents and directly raise their internal temperature. This is an exceedingly important fact, as the cell is the workshop of chemical metabolism. The mechanism is practically a parallel with that of Experiment III.

This same principle may be applied on a larger scale to the passage of the current through the skull, the resisting walls of the skull corresponding to the glass sides of the bottle and the contents to the water. Similarly, it is conceivable that wattless current may cross the cortex of the limb bones in a similar manner to heat up the marrow contained therein. In short, it furnishes a method whereby high frequency current can pass thin layers of highly resisting tissues without heating them to any appreciable extent and in such fashion as to discount entirely the effect of their resistance upon the distribution of the current and heat. The distribution of high frequency currents must therefore be different from that of constant potential. In a sense this forms some justification for the statement that diathermy currents take a more direct route than is warranted by the laws of resistance. What really happens is that the high frequency modifies the effective resistances, but the current otherwise conforms to rule. McClendon<sup>(6)</sup> has found specially marked variations of the resistance of living cells to currents between 1,000 and 3,000 kilocycles, a range which just covers that of medical diathermy.

From a consideration of the electrical diagram of the cell and of the fact that capacitance effects increase with increasing frequency, it seems legitimate to suggest tentatively that with increasing frequency greater proportions of current tend to pass directly through the cell body instead of through the extracellular fluids. Thus, though less total heat is produced, a greater part of it is generated within the cell. A logical expansion from this is that perhaps the special virtue of diathermic treatment is this property of generating intracellular heat and of stimulating metabolism at the source.

#### Joule's Law.

The whole of this therapy being based on the Joule effect of the current, it is certainly of interest to determine whether the heat produced conforms to Joule's formula,  $H = 0.24 I^2 RT$  calories. Much work has been carried out on this question, generally saline solutions of varying resistance being used to represent the patient. Bordier<sup>(7)</sup> and d'Arsonval<sup>(8)</sup> were unable to reconcile the heat as measured in experiment with the heat as calculated from the formula, and announced that the diathermy current did not produce heat according to rule. The more recent researches of Hemmingway reverse this decision.<sup>(1)</sup> In a thoroughly scientific manner he first measured the high frequency resistances of the human body as cited above and found them to range between 20 and 200 ohms, with the greater portion in the region of 20 to 60 ohms. He then passed the current through saline cells of corresponding resistances measured also at high frequency. The heat was estimated by a calorimeter method and the result proved a correspondence with Joule's formula, within the limits of experimental error. D'Arsonval's results were apparently due to

the use of saline solution and other solutions of as high as 35,000 ohms resistance. At these high ohmages, in small cells only two centimetres wide, much of the current passed between the electrodes as a capacity current (Figure I, a). It was measured on the meter and used in the calculation, but produced no heat. Hence the discrepancy between the calculated and observed result. A further source of error was the measurement of his resistances at low frequency instead of at high frequency.

The question arises whether this capacity current passing directly from electrode to electrode is of importance in ordinary clinical work. Hemmingway also took up this matter.<sup>(1)</sup> His experimental electrodes were five centimetres apart and his resistances of clinical dimensions, and with these arrangements he found practically no evidence of any wattless current. As clinical electrode distances are usually much more than five centimetres, we may safely conclude that the current as measured on the meter is the true heating current. This current value, substituted in Joule's formula with the value of the effective resistance measured at high frequency, will give the actual amount of heat generated. These capacitance effects as between electrodes must be distinguished from the capacitance effects of strata of tissue occurring in series. In Figure II, b, the first is represented by c and the second by CC.

The above discussion serves to point out some physical factors which influence the production and distribution of heat. These factors operate throughout the whole path of the current through the tissue which is probably a complex arrangement of condensers and resistances in series and parallel connexions.

#### BIOLOGICAL CONSIDERATIONS.

Heat and cold have invariably a stimulant and sedative effect respectively upon living tissue, provided their intensities do not exceed certain well defined physiological limits, in which case they become destructive. The truth of this statement is not universally realized, because we are more familiar with the reactions of heat and cold than with their primary actions. We think a hot day depressing and a cold shower stimulating, but what we really experience are secondary effects which in a complex organism often supervene so swiftly as to conceal the primary effect completely. As a matter of common medical knowledge and experience, heat stimulates metabolism and all chemical processes, increases circulation, relaxes spasm and relieves pain. These factors, consequent upon the heat generated, constitute the essential therapeutic action of diathermy.

The temperature of any object represents a balance between the incoming and the outgoing calories. It remains to consider what, in a practical diathermy treatment, constitutes the cooling mechanism. The factors operating may be summarized under three heads: (i) Radiation from the

treated part into the surrounding medium, (ii) direct conduction to cooler tissues outside the influence of the heating current, (iii) convection of heat away from the part by the blood stream. The first two are purely inert and physical, but the third is a biological reaction of great significance.

Tracing the fate of the heat generated in a local treatment, we find that as the temperature of the part commences to rise, reactions occur which are fairly well understood and are mostly vascular. An increase of local metabolism causes a local accumulation of metabolites with a corresponding deficiency of oxygen. Lewis<sup>(9)</sup> identifies these metabolites with his H-substance and indicates that the production of such substances is the normal means of regulating the local blood flow to the metabolic requirements of the tissue concerned. However described, they act as a chemical stimulus causing dilatation and increased permeability of the capillaries and small vessels, with consequent increased circulation and accentuated tissue exchanges. Axone<sup>(10)</sup> and antidromic impulses have been shown to contribute to this vaso-dilatation in the skin in response to temperature stimulation, and there is not much reason to suppose that deep tissue circulation is regulated differently.

The whole response is at first purely local, bringing more blood to the pathway of the current. This blood absorbs heat and departs on its normal round at a higher temperature than that at which it arrived. This heat it dissipates throughout the general blood stream. With heavy treatments the accumulation of heat in the blood is considerable and may evoke the general heat regulating mechanism of the body to the extent of dilated cutaneous capillaries, increased respiration and pulse rate and even sweating, particularly if the room temperature be high. With adequate blanketing and heavy currents passed through the whole trunk it is possible to raise the body temperature to 41° C. or more, but in ordinary treatments, even with heavy autocondensation, a rise of more than 0.5° to 0.6° C. is rarely seen.

We thus have two aspects to the case. Any local diathermy treatment begins as a local accumulation of heat, but in response to inevitable vascular reactions tends to general heating of the body and consequent general stimulation.

#### Local Effects.

Considering the local condition, the hotter the part becomes, the more vigorous is the blood flow in an endeavour to cope with the increasing temperature. Treating a hand with the finger tips in water and a band electrode around the forearm, it is possible to raise the temperature in the interdigital clefts to 41° or 42° C., but at this point heavy aching occurs in the wrist, which apparently signifies that the limit of vascular adaptation has been reached. If heavy currents are turned on suddenly, this aching occurs much earlier than if the same intensity is imposed more gradually. The vascular responses are not given sufficient time to

develop and heat accordingly accumulates too rapidly in the part.

In the diathermic treatment of cervical gonorrhœa a small hollow electrode containing a thermometer is placed in the cervix. A temperature of 45° to 46° C. is then maintained for thirty to forty minutes, with the idea of destroying the gonococcus *in situ* by heat action alone. The electrode has a superficial area certainly not more than five square centimetres, and a current value in the region of one thousand milliamperes is used. The use of such a high energy density through mucous membrane is possible, as mucous membrane has a much lower resistance than skin. The safe maximum for moist skin is usually given as twenty milliamperes per square centimetre of skin-electrode contact. From our present point of view the treatment is interesting in that we can directly see the suffusion of the cervix with blood as the temperature rises. The magnitude of the cooling effect of the blood stream is shown by the constant watchfulness necessary to maintain the temperature at the desired mark. Commencing at about 900 milliamperes, usually a reading of 45° C. is attained in about ten minutes. The cervix becomes increasingly suffused with blood and at the end of twenty minutes it has become necessary to raise the intensity to 1,200. This tendency for the temperature to fall is very considerable and is due to the increased ablation of heat by the blood *plus* a fall in the resistance of the cervix due to its increased vascular content. At the conclusion of the session the current may be shut off suddenly with the electrode still in position. The cooling effect may then be further gauged by the fact that the temperature falls 6° C. in the first minute.

Binger and Christie<sup>(11)</sup> have also shown the actual heating of the blood on the laboratory animal. Diathermizing the lungs of anæsthetized dogs, they measured the temperature of the venous and arterial blood on the right and left sides of the heart respectively. Normally the arterial stream is cooler than the venous, but while a diathermy current is passing through the lung, the effect is reversed, as shown by the following figures from their paper. They calculated that one-half of a large calorie is removed from the dog's lung per minute by this means.

Temperature before Diathermy, Degrees Centigrade.				Temperature during Diathermy, Degrees Centigrade.		
Experi- ment.	Arterial.	Venous.	Dif- ference.	Arterial.	Venous.	Dif- ference.
D 25	36.29	36.37	- 0.08	39.70	39.45	+ 0.25
D 40	38.22	38.29	- 0.07	40.01	39.89	+ 0.12

A consideration of these miscellaneous facts and observations must convince us of the magnitude of this cooling effect of the blood stream and hence by inference of the reality of the increased blood flow resulting from diathermy treatment.

We may now summarize the local effects of diathermy in the order of their apparent importance:

1. An increase in the volume of blood flow resulting from vascular dilatation, the degree of which depends, within physiological limits, upon the electrical energy used. This blood is heated and hence is chemically more active than usual.

2. A rise in local metabolism, the degree of which depends upon the actual temperature attained. It has already been suggested that some at least of this heat is formed directly within the cell. Taken together, these two factors indicate an activated tissue flooded with the materials for repair, maintenance and defence.

3. The relief of pain and spasm, probably by-products of numbers one and two, and not well understood. They are nevertheless very real clinical entities.

4. The direct lethal action of heat upon micro-organisms, which is rarely possible. Probably even in the cervical treatment of gonorrhœal rheumatism the action is largely a stimulation of local and general body defences.

Of these the increased permeation with heated blood is probably the therapeutic factor of most importance. It occurs with all applications of heat, but the fact that diathermy distributes the heat deeply throughout the tissues renders the vascular dilatation more widespread and therefore more particularly valuable. The second factor of rise in metabolism depends upon the actual temperature attained in the part. In small areas, such as I have indicated in the case of the fingers and cervix, sufficient amounts of energy are available to cause considerable local rises. In treatments of large parts of the body, however, such as the chest and abdomen, high local temperature cannot be attained for two reasons. The volume of tissue is too great to be intensely heated by the currents usually available, so that the vascular cooling predominates. Secondly, owing to the large amount of blood involved, the heat formed in a large volume of tissue is very quickly disseminated to raise the whole body temperature. This in turn excites the total bodily heat-regulating mechanism. The circulating blood is cooled off in the dilated skin capillaries of the skin just as in the cooling system of an automobile with wide open radiator shutters and thermostatic valve. The cooling efficiency of the whole organism is thus largely enhanced, and heat is radiated out of the body as fast as it can be put in, the temperature of the local part only maintaining a degree or fraction of a degree above the rectal reading.

Reverting to the articles by Christie and Binger,<sup>(12)</sup> we find that they investigated these vascular responses to diathermy in an exceedingly thorough manner. Using anæsthetized dogs, with factors of clinical proportions, they found it impossible to raise the temperature of normal lung more than a fraction of 1° C. above the rectal readings so long as the circulation remained intact. Tem-



porary ligation of the lung vessels caused a prompt rise so long as the ligation was maintained. The reading fell to the former level when the blood was readmitted to the lung. Death of the animal caused a still greater increase of local temperature. We have already mentioned the increased temperature of the arterial stream from the heart under these circumstances. Taken together, these facts clearly indicate the cooling rôle of the vascular responses to the current. In patches of artificially induced pneumonia, owing to the decreased vascularity, it was proved possible to raise the local temperature as much as  $2^{\circ}$  C. above that of the surrounding tissue. In all these experiments the rectal temperature of the animal rose as much as  $4^{\circ}$  to  $5^{\circ}$  C., but it must be remembered that the animals were anaesthetized, the heat-regulating mechanism being thus impaired. In any case, the mechanism in the dog is distinct from that in the human.

The importance of these researches seems to lie in that they place the therapeutic emphasis not so much on the actual temperature attained as on the degree of increased blood flow induced. The problem of the diathermic treatment is therefore to produce and maintain this strictly physiological reaction by means of the heat energy generated by the current.

#### General Effects.

The general effects of heating the blood stream cannot be dismissed as of little significance. If heat is conceded to be a stimulant, the effect of warmed blood passing through the heart might reasonably be assumed to be a cardiac tonic and a general metabolic whip. Indeed, in the latter sense the current has been used to stimulate individuals with cold lethargic constitutions and even in hypothyroid cases. Crile<sup>(13)</sup> has advocated the use of the current to raise the body temperature in surgical shock, diathermizing the liver from side to side, both before and after operation. In artificial diathermic fever, recently introduced and specially applied to the treatment of general paralysis of the insane, use is made of the rise of body temperature, both to stimulate the immune reactions of the body and to destroy or restrain the spirochæte *in situ* by the direct action of heat. With adequate heat insulation and heavy currents passing for some hours through the whole trunk, body temperatures of  $41^{\circ}$  C. or more are attained. Currents up to 8,000 milliampères have been employed.

Autocondensation has been extensively used for the treatment of high blood pressure and had the advocacy of Clifford Allbutt. Considerable trial has convinced me of the benefits derived. Here again there is no necessity to call upon any other resources than those of heat to explain the results achieved. Considerable quantities of heat are introduced into the body with usually a small rise of temperature. Flushing, capillary dilatation and even sweating will occur. The chemical processes of the body are quickened with an increase in the solids in the urine. The heart muscle is stimulated

and relaxation of the vascular periphery occurs, leading to a fall of blood pressure. This fall as a whole is usually temporary, but over a series of sessions there is, as a rule, a small net gain with considerable symptomatic improvement. It appears as if the redistribution of the vascular load, the tonic effect of the heat on the heart muscle and the metabolic stimulus interrupt a vicious circle, allowing the normal tendency to correction to exert its influence. Improvement for some months may ensue and the process may be repeated at intervals till at last organic changes become severe and this therapy fails in conjunction with all others.

On the hypothesis of vascular dilatation of the cardiac vessels and the relaxation of spasm, cardio-diathermy has been used at the National Heart Hospital, London,<sup>(14)</sup> with promising results in cases of angina. The general heating of the blood stream probably plays a large part in the benefits obtained.

For the relief of spasm in general heat has always had a reputation, and the deep heating effect of diathermy renders this heat therapy available in many conditions which superficial applications from the nature of things cannot reach. The application of through-and-through diathermy to patients with biliary and renal colic to aid the passage of a calculus (if passage is at all possible) is a reasonable therapeutic procedure, and its similar application to patients with spasmodic dysmenorrhœa often affords relief.

Examples could be multiplied, but it is only necessary to realize that heat is the actual therapeutic instrument we use when we turn to the diathermy machine. The indications and contraindications will thereupon write themselves for us naturally. The machine itself is an elaborate tool used to produce deep-seated heat within the body by electrical means, but the basic principles on which the therapy rests were accepted before Hippocrates saw the light. They are tacitly accepted by every physician as he daily prescribes the ubiquitous and useful hot fomentation. The form changes, but the principle stands firm always.

In conclusion, it will be plainly seen from the foregoing that the diathermy current acts by normal physiological means and that therefore no miracles will occur through the manipulation of various switches in their due and proper order. Probably the most striking and speedy results are to be seen in purely traumatic conditions, in which healthy tissues seem to accelerate their repair markedly with the current. The repair of fractures seems a case in point. With chronic pathological lesions therapeutic efforts of any kind must be persevering and prolonged if relief is to be gained; and diathermy is no exception to this general rule.

#### SUMMARY.

A review of some physical principles affecting the therapeutic uses of the diathermy current has been made with an attempt to justify all its effects on the basis of heat alone.

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PITUITARY AND SUPRASELLAR TUMOURS.<sup>1</sup>

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So many patients suffering from pituitary and suprasellar tumours first complain of visual defects that the responsibility of exposing the early cases has to be placed on the oculist. He has, therefore, to keep pace with increasing knowledge and to sift the rapidly growing evidence based on a large number of cases collected by a few well known workers who do not profess to be ophthalmologists, but who, nevertheless, are making it possible for the ophthalmologist to acquire the knowledge necessary not only to expose the early cases, but to differentiate the actual lesion. Hitherto many of these cases have been labelled as retrobulbar neuritis, toxic amblyopia *et cetera*, with the result that many patients have been subjected to rhinological operations and other unnecessary forms of treatment.

## Pituitary Tumours.

## Chromophobe Adenoma.

Chromophobe adenoma is the most common of all pituitary disorders and occurs almost without exception in adult life.

Owing to the fact that the diagnosis of the condition depends mostly on local rather than general disturbances, these latter often being inconspicuous or resembling the symptoms of early myxœdema, it is the oculist who is usually the first to be consulted in a case presenting some or all of the usual signs associated with an indefinite history of visual

defects, which the patient often finds difficult to describe. It is only by a thorough and searching examination of such patients that the oculist can hope to avoid a wrong diagnosis. There may be no primary optic atrophy present to suggest the possibility of a pituitary tumour, and the patient cannot tell you that he has an early bitemporal or other visual field defect. Such defect may escape unnoticed if the perimeter is not used. This is well demonstrated by the following case.

CASE I.—F.L., a man, aged thirty-nine years, was first seen on November 13, 1930, when he complained of failing vision for near work, which he had first noticed six months previously, but which was gradually becoming worse. He could see more letters in a word than should be there, and if he had three stamps in his hand he would at times see four or five. He did not complain of headache or other disturbance of a general nature.

The vision of his right eye was  $\frac{5}{10}$ , of his left eye  $\frac{5}{20}$ , but with both eyes he read  $\frac{5}{10}$ . There was no refractive error. The right disk was very slightly paler than the left. There were two degrees of exophoria. In the visual fields there was a bitemporal defect, which was relative over the greater part, but absolute in a paracentral area on either side.

X ray examination then revealed a most perfect example of "ballooning" of the sella, the floor of which was nearly on a level with that of the sphenoid, with relatively normal superior relations to the clinoids; both of these facts are very important from the point of view of the transsphenoidal operation (Figure I).

The physician reported no evidence of any disturbance of pituitary function.

On November 25, 1930, a transsphenoidal decompression of the floor of the sella was performed by Dr. Pülleine and myself, when half the substance of the pituitary gland was removed. Recovery was uneventful, and on December 2, 1930, the vision in each eye was  $\frac{5}{10}$ . On December 8, 1930, the vision was  $\frac{5}{10}$  in each eye, and the fields were perfectly normal. On October 29, 1931, his only complaint was of an occasional slight dull ache behind the right eye; there was no disturbance of vision. His vision is now  $\frac{5}{10}$  with the right and  $\frac{5}{20}$  (partly) with the left. The disks appear to be normal. There is a slight relative defect in both temporal fields, more especially in the lower quadrants.

There is a little indefinite fullness in the right olfactory cleft, near the sphenoid, otherwise nothing abnormal can be detected by rhinological examination.<sup>1</sup>

This case is a fairly typical example of the condition in its relatively early stages. The absence of any primary optic atrophy or general disturbance should not deter the oculist from the use of the perimeter. Had this case been allowed to progress till the diaphragm of the sella broke down, the rhinologist would have run a grave risk of causing meningitis had he done a transsphenoidal operation.

## Chromophile Adenoma.

Owing to the fact that the chromophile adenomata are associated with hyperactivity of the pituitary gland, it is the usual thing to divide the clinical types into two groups: (i) gigantism and (ii) acromegaly; but owing to the fact that it is only a subdivision of the age of onset, with the consequent difference in outward manifestations, it is not necessary to make such a distinction from the point of view of the ophthalmologist, because the consequences are the same as far as he is concerned. It is, however, rather important to note the comparative rarity of giants, that is, development

<sup>1</sup> Read at a meeting of the Eye and Ear Section of the South Australian Branch of the British Medical Association on November 3, 1931.

<sup>1</sup> This patient was seen again on May 9, 1932, and was feeling normal; no visual or field defects could be found.

before adolescence. To put it in the words of Cushing,<sup>(1)</sup> "a preadolescent chromophile adenoma resulting in hyperpituitarism is about as rare as a preadolescent chromophobe adenoma resulting in hypopituitarism".

Unlike the signs of the chromophobe adenomata, the local signs are rarely evident until the general effects of hyperactivity are well established. That being so, the physician rather than the ophthalmologist is generally the first to be consulted by these people; but the physician rarely calls in the surgeon to alleviate the hyperactivity and its consequent ill effects; he prefers to leave that responsibility to the oculist when vision begins to deteriorate. However, with improved surgical technique and consequent lowering of the mortality rate, I can foresee that the oculist will gradually be relieved of this responsibility.

#### Suprasellar Tumours.

##### *Suprasellar Meningiomata.*

Suprasellar meningiomata apparently arise from the arachnoid in the region of the chiasma. Over thirty cases have recently been reported.<sup>(2) (3)</sup> An important point has been stressed by Holmes,<sup>(4)</sup> who remarks that these tumours do not have a common meningeal site of origin, but are nevertheless primarily situated in front of the chiasma and between the optic nerves. It is because of this that these tumours usually give rise to pressure effects on one optic nerve in advance of the other, although it is conceivable that in a few cases the advancing pressure could be equally distributed on each side and that the chiasma could be situated further forward than usual. In both of these cases the usual chiasmal syndrome would be produced. It is therefore important in taking the history of patients with a chiasmal syndrome to ascertain whether one eye was affected for some time before the other. Cushing reports one such case, in which there was a defect in the temporal field of one eye for eight years before any defect in the other eye was discovered. Holmes reports another with blindness in one eye before the other began to fail. On the other hand, several cases have been reported in which the interval was much shorter. These tumours usually occur in people forty to fifty years of age. Endocrine disturbance, headache and vomiting practically never occur, except perhaps in the very late stages. X ray examination as a rule gives no information.

In view of the fact that these tumours are easily removed in the relatively early stages, with permanent relief to the patient, it is necessary for the ophthalmologist to be fully aware of his great responsibility on being confronted with a middle-aged patient showing signs in one eye of primary optic atrophy, loss of temporal visual field, a central or paracentral scotoma on the temporal side, in whom the physician and radiographer can find no abnormality. In such circumstances it is very easy for one to make a provisional diagnosis of something else, with the result that when the other

eye is showing signs of trouble, the growth has probably reached such large dimensions as to have enveloped the neighbouring large vessels, thus rendering its removal difficult or impossible.

##### *Suprasellar Adenomata.*

Occasionally a pituitary adenoma develops without any enlargement of the *sella turcica*. In such a case the extrasellar enlargement produces a syndrome which may be difficult or impossible to distinguish from that produced by a suprasellar meningioma. There are two anatomical possibilities which may be the cause of such an occurrence: (i) The tumour may arise from an *Anlage* situated above the sellar diaphragm in the stalk, or (ii) the hypertrophied portion of the gland may be superficial and the diaphragm imperfect, with the result that it grows out into the cranial cavity. Cushing and Davidoff<sup>(5)</sup> have described the findings at autopsy in such a case. The patient was an acromegalic with apparently normal *sella turcica* and little or no disturbance of vision, due to the fact that a huge chromophile adenoma had burst through the diaphragm on one side of the chiasm, missing it and then expanding in the temporal lobe. The presence of endocrine disturbances described above may assist one in making a preoperative diagnosis; but it has been found that the remainder of the gland is not often subject to any great pressure and therefore functions as usual, so that endocrine disorders may be entirely absent.

Cushing<sup>(6)</sup> has described three examples encountered at operation. As a result of this experience he has suggested one or two points that may be of assistance in making a preoperative diagnosis of the condition: (i) X ray examination, although it may reveal a normal contour of the sella, will often show a much greater degree of pressure absorption than is seen in suprasellar meningioma; (ii) mild pituitary dysfunction may be present; (iii) the symptoms of adenoma progress more rapidly.

##### *Craniopharyngiomata.*

"Craniopharyngioma" is the satisfactory term used by Cushing to cover that group of tumours and cysts arising as the result of defective closure of the cranio-pharyngeal duct.

Although these tumours occur at any age, being congenital, they are mostly found in childhood. X ray examination may or may not reveal enlargement of the *sella turcica*. Lime salts may be deposited in these tumours; thus the X ray evidence is often of very great service by showing up large or small shadows just above or occasionally within the sella. There is nothing characteristic about the type of chiasmal syndrome associated with these tumours. The endocrine disturbances depend on the age of the patient and the site of the lesion, so that the manifestations may be many and variable. If, as is commonly the case, the hypothalamic area is disturbed, polyuria, hypersomnia and adiposity will probably be evident. The signs of hypopituitarism which commonly occur will vary



according to whether the patient has reached or passed adolescence. There is usually little difficulty in diagnosing these tumours, although at times it becomes difficult to distinguish them clinically from suprasellar meningioma.

#### Notes on Cases.

CASE II.—F.B.M., a school mistress, aged fifty-five years, presented herself on March 19, 1930, complaining of an ache in the right eye, which had begun six weeks previously. The right ear and even the whole of the right side of the head were aching constantly, the pain was worse in the mornings. She had seen double a few times recently and the right eye had gradually become intolerant of light. Her hat hurt the right side of her head and she was unable to sleep with the right side of her head on the pillow. There had been a slight nasal discharge recently.

The vision of either eye was  $\frac{5}{60}$ ; but she could read  $\frac{4}{6}$  with either eye with a hypermetropic correction. The right pupil was a little larger than the left and more sluggish in its activity to light and accommodation. There were three degrees of hyperphoria. Tension was normal. No abnormality was observed in the fundi. There was no visual field defect nor paracentral scotoma. Nasal examination revealed obstruction on the right side, with complete occlusion of the right naso-frontal duct. The frontal and maxillary sinuses on the right side were tender to pressure and dull to transillumination.

On April 1, 1930, resection of septum and removal of right anterior end of the middle turbinate were performed. The patient obtained immediate relief.

On April 11, 1930, an X ray examination of the sinuses and skull revealed normal antra and frontal sinuses, but the sphenoidal sinus was practically obliterated by what appeared to be a spontaneous decompression into it of the floor of the sella, the posterior clinoid processes being completely destroyed (Figure II).

On May 9, 1930, she still had aching round the right eye and was unable to read without discomfort. Slight but definite exophthalmos of the right eye was now evident. The physician reported no general evidence of disturbance of the pituitary gland, but in view of the X ray evidence that the sella had been spontaneously decompressed, he felt that there should be no danger attached to giving her deep X ray therapy, with the probability of improvement if the lesion was a pituitary one.

On June 6, 1930, having had three sittings of deep X ray therapy, she complained of feeling giddy and sick. The right nostril was blocked and proptosis more marked. The visual fields were normal; there were twelve degrees of esophoria. Nasal examination revealed a body like a polypus high up at the back of the right olfactory fissure, extending down into the nose.

She was admitted to hospital on June 10, 1930, suffering from intense headache, vomiting, signs of increased intracranial pressure, almost total ophthalmoplegia, internal and external, on the left side, and paralysis of the right external rectus muscle. The vision of the right eye was  $\frac{5}{60}$ , of the left,  $\frac{5}{60}$ .

X ray examination revealed further destruction of the bone bounding the *sella turcica*, and the erosion had continued along its anterior wall (Figure III).

On June 11, 1930, under local anaesthesia, the tense polypus-like cyst in the right side of the nose was opened and a considerable quantity of straw-coloured fluid was drained off. Portion of the cyst wall was removed for examination and the cyst allowed to drain.

On June 15, 1930, she was much improved, her headache had gone, proptosis was considerably reduced, and the ocular muscles were regaining their power. Fluid was still draining from the nose. The pathologist reported subacute inflammatory reaction in the wall of the cyst, lined by stratified epithelium.

On June 11, 1930, her condition could be regarded as normal, both from an ocular and rhinological point of view. The patient then resumed her occupation and has experienced no trouble since.

The question to be decided in this case is the origin of the cyst. The X ray evidence and order of events after the deep X ray therapy are all in favour of an intracranial or intrasellar origin. The pathologist's report is in keeping with the lesion being a cyst of Rathke's pouch, but the one thing against this is the absence of any field defect at any time during observations. It is possible that this can be explained by the giving way of the floor of the sella and the prevention on this account of any pressure from below on the ophthalmic tract. The deep X ray therapy certainly had the effect of increasing the exudation into the cyst, as after three sittings the symptoms advanced rapidly and the cyst evidently sent a process laterally into each sphenoidal fissure, thus causing the pressure which gave rise to the ocular palsies and also the proptosis on the right side.

CASE III: T.E., a female, aged fifty-two years, was referred by Sir Henry Newland for an ocular report on October 9, 1930, and it is with his kind permission that I publish these notes. Her vision had begun to fail twelve months previously, since when her glasses had been changed several times. During this same period her memory had been failing and there had been an uncontrollable desire to sleep. She had a very great thirst and polyuria. There was an occasional headache on the right side.

With her right eye she read  $\frac{5}{60}$ , and with her left,  $\frac{4}{60}$ . The right disk was paler than the left.

Although the patient persisted in going to sleep during this examination, it was quite evident that there was almost complete bitemporal hemianopia, more advanced in the lower quadrants. X ray examination of the *sella turcica* and the suprasellar region revealed no abnormality (Figure IV).

A large suprasellar cyst was exposed at operation by the transfrontal route.

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- <sup>(6)</sup> H. Cushing: "The Chiasmal Syndrome of Primary Optic Atrophy and Bitemporal Field Defects in Adult Patients with a Normal Sella Turcica", *Conciliium Ophthalmologicum Hollandia*, 1929, page 97.

## Reports of Cases.

### OSTEOPLASTIC RESTORATION OF THE SKULL<sup>1</sup>

By R. ANGEL MONEY, M.C., M.B., Ch.M., F.R.A.C.S.,  
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SINCE the days of Hippocrates head injuries have always been regarded as having serious consequences, especially when portion of the skull has been lost, either as a result

<sup>1</sup> The patients were shown at a meeting of the New South Wales Branch of the British Medical Association at the Royal Prince Alfred Hospital, Sydney, on May 12, 1932.

of trauma or operation or both. When the bone is missing from the cranial vault and there is no increase in the intracranial tension, *hernia cerebri* does not occur, although there may be some bulging of the unprotected meninges, with an accumulation of fluid, which is exaggerated by gravity, by alteration of posture, and by effort. However, this appearance, and the pulsations visible in it, synchronizing with the heart beat, are rather terrifying to the patient, and especially to his parents, relatives and friends. Analogies are generally drawn to some relative or acquaintance who suffered from a similar disability, with or without "a plate in his head", and who became epileptic or insane. Changes in behaviour and disposition, headaches, fits *et cetera* are expected of the poor sufferer, who "has never been the same since" and who rapidly develops an inferiority complex. Apart from any real danger which may occur from an injury to the unprotected area and the formation of adhesions between the surface of the brain, the meninges and the scalp, leading to severe headaches and even Jacksonian epilepsy, the patient lives in real dread of the imaginary consequences that may follow such a happening. A bad psychological outlook is thus engendered within him and the ground prepared for chronic invalidism as far as his earning capacity is concerned. A ready excuse is always at hand for any of his shortcomings and misconduct, however great or small they may be.

Such deficiencies in the bony wall of the skull were at one time closed with plates of silver, vulcanite, celluloid *et cetera*, but these have never proved themselves ideal, nor in the lay opinion did they render the bearer immune from after-effects. Indeed, only last week a "cat" burglar, aged thirty-three years, whose mental age was fourteen, ascribed before the magistrate his kleptomaniacal tendencies to the fact that he was told he had a silver plate put in his head when thirteen years of age, although a medical examination failed to reveal any evidence of its presence.

Autogenous bone or cartilage grafts were tried extensively during the Great War in large numbers of cases and proved very satisfactory. The graft was usually taken from the subcutaneous surface of the tibia or a rib split longitudinally and opened out. In both these instances the area which could be closed with a single graft was obviously limited; many separate pieces were frequently required to close a large gap, and it was very difficult to make a firm and neat job with these. Pickerill<sup>1</sup> suggested making use of the internal plate of the iliac bone, and this method was used in the two cases here described. The iliac bone is ideal for this purpose, because a large enough area can be obtained in a single graft to close almost any deficiency in the skull, it is curved in the right fashion, and its inner surface is smooth and can be placed in contact with the *dura mater*. It is a strong bone and grafts well, although its density is much less than that of the tibia, hence skiagrams taken even twelve months afterwards only show the new bone very faintly (see Figure I), whereas tibial grafts show up well. However, the clinical and functional result from the patient's and his relatives' point of view is splendid.

The general technique described by Pickerill was followed in each case. Horsley's wax was used to prevent hemorrhage from the diploe of the iliac bone, and strict hemostasis was secured in the skull wound. The patient was kept in bed for sixteen days after the operation. In view of the fracture which occurred in the second case, due to muscular action whilst the patient was in bed, it may be advisable where a large graft has been taken, to apply a short, closely fitting plaster spica around the pelvis and thigh until the iliac bone has had time to regenerate.

#### Case I.

J.W., a male, aged seven years, was knocked down by a motor cycle twenty months ago, whilst crossing a road. He did not lose consciousness. On admission to hospital he was dazed and irritable. There was a compound depressed fracture of the skull in the right parietal region. Portion of the scalp was missing. Hair and *débris* had been driven into the depths of the wound.

Under intratracheally administered ether anaesthesia the skull was shaved and cleansed with liquid soap and turpentine. The skin wound was surrounded with sterile towels, and the lacerated edges were excised completely. The right parietal bone was found to have a comminuted depressed fracture, about three centimetres in diameter. There was much splintering, and the inner table had torn the *dura mater* and the brain substance. Hair and dirt were embedded in the lacerated brain substance. All the splintered bone was removed, together with the foreign bodies. The edges of bone were nibbled away until an intact inner table was found. The brain substance was flushed with saline solution. The tear in the *dura mater* was sutured with catgut and the edges of the scalp completely apposed with silkworm gut sutures. A small rubber tissue drain was inserted under the scalp. This was removed two days later. The wound united by primary intention.

One year later there had been no regeneration of bone. There was a circular deficiency in the right parietal bone, about four centimetres in diameter, at which pulsations were readily visible, and slight bulging could be seen and felt. No headaches or abnormal symptoms were complained of; but the boy wore a jockey's metal skull cap continuously and was not allowed to play games with his mates for fear of injury. He was readmitted to hospital and had a bone graft, from the inner table of his right iliac bone, fitted into the gap in his right parietal bone. The wounds healed primarily. Unfortunately, no skiagram was taken prior to grafting, but a film taken recently (see Figure I) shows the final result. His skull now feels hard and firm everywhere, and there are no pulsations. He is going to school and playing games with boys of his own age.

#### Case II.

B.M., a male, aged thirty-nine years, received a head injury when two years old, in the right parietal region, necessitating a craniectomy for depressed fracture. No disability occurred until he was twenty-two years old, when he was hit on the head with a bayonet, after which he had suffered from nocturnal "fits" on frequent occasions.

Seven years ago he was operated upon and more bone removed, without relief. One year ago, following encephalography, which revealed some underlying cortical shrinkage, with arachnoidal adhesions and cyst formation, an extensive exploratory craniotomy was performed. A large subarachnoid cyst was removed, together with portion of the underlying cerebral cortex and the overlying adherent *dura mater* and arachnoid. The defect in the *dura* was filled in with Cargile membrane and the scalp replaced. Considerable improvement resulted, only three fits occurring in six months. However, a large defect in the cranium (see Figure II) was still present.

Six months ago, a bone graft from the inner table of the right iliac bone was fitted into this gap. Considerable difficulty was experienced in obtaining a sufficiently large piece of bone, and towards its centre the whole thickness of the iliac bone had to be used. The immediate convalescence was uneventful; the wound healed by primary union, except in one corner.

One month later, on Christmas Eve, the patient had a fit, with violent extensor spasms, in his sleep. Next morning he felt a pain in the right side of his pelvis and was unable to walk.

Physical and radiological examination revealed a fracture with outward displacement of the iliac bone, at the site where the graft had been removed (see Figure III). A plaster spica was applied for six weeks, enabling the patient to walk about without discomfort. Union followed, and no disability exists at present. The bone graft has taken (see Figure IV). The patient feels very greatly benefited and has been able to return to work.

#### Reference.

<sup>1</sup> Percival Pickerill: "A New Method of Osteoplastic Restoration of the Skull". THE MEDICAL JOURNAL OF AUSTRALIA, August 22, 1931, page 228.

## TUBERCULOUS ENTEROCOLITIS.

By J. BURTON CLELAND, M.D.,  
Professor of Pathology, University of Adelaide.

IN THE MEDICAL JOURNAL OF AUSTRALIA for November 21, 1931, page 656, is an article on tuberculous enterocolitis, under the heading "Current Comment". An abstract is given of a recent paper on the subject by Andrew L. Banyai in *The American Journal of the Medical Sciences*, September, 1931. In the summary it is mentioned that as high a proportion as 92.6% of persons who have died from pulmonary tuberculosis have been found affected with tuberculous ulceration of the intestines.

I have looked through my tabulated results of *post mortem* examinations at the Adelaide Hospital, and find that out of 111 patients with advanced pulmonary tuberculosis, 56 had tuberculous ulcers in the intestine, either slight and few or, usually, deep and numerous. This represents 50% of patients who died from pulmonary tuberculosis in South Australia. In one case the colon presented the appearance of a dysenteric ulceration along the whole of its extent, and here we came to the conclusion that in all probability the patient had had a previous dysentery or an ulcerative colitis and that the tubercle bacilli that had been swallowed had been grafted on to the previous lesions.

The author of the comment adds that healing is known to occur in tuberculous ulcers of the human intestine. In a recent case in which there was a very chronic fibroid type of pulmonary tuberculosis, I noted that the appearance of the ulcers in the intestine was in a number of places fibrosed or sclerosed, as if a very good attempt at healing by fibrosis was taking place. The chronic nature of the lesion in the lungs was accompanied by a good deal of tilting of the heart. In all probability the number of tubercle bacilli being discharged from the lungs and passed into the intestines had been much reduced; this perhaps gave the intestines a chance to begin to overcome or control the tuberculous invasion.

## Reviews.

## THE PNEUMOCOCCI.

A SHORT record of some experimental work carried out by A. Cowan Guthrie has been published under the title of "Research Work on the Pneumococci and Their Enzymes".<sup>1</sup>

The experiments were commenced in 1919 and continued in 1926 and 1930. The earliest experiments and the conclusions arrived at are described in the first eight pages of the book. Preceding this is an introduction in which various terms are described and an explanation given of the reasons for embarking on the work.

The first series of experiments resulted in the conclusions being drawn by the author that complement in the presence of immune serum acts on pneumococci in such a way that the endotoxins of the pneumococci pass out into the surrounding serum, leaving the organisms detoxicated and so a prey to the phagocytic action of the leucocytes.

The later experiments are concerned with showing the correctness of these deductions relating to the diffusion of endotoxin from the bodies of the pneumococci to the surrounding medium.

No effort has been made to set out the results in a readable manner. There appears to be much unnecessary repetition of experiments which are very similar in nature,

while it is not always clear why certain conclusions were arrived at.

Pages 21 to 35 are alleged to be given to a description of experiments done in repetition of those carried out in 1926. Actually they are a repetition of the subject matter of pages 8 to 21. If the experiments were actually repeated and redescribed, it is hard to believe that in Experiment 5 (pages 14 and 15 and pages 27 and 28) the same tubes and blood agar plates should on each occasion show a similar contamination.

The later experiments carried out were directed towards showing that the endotoxins were actually present in the surrounding medium after removal of the pneumococci. A hæmolytic and a proteolytic action were demonstrated as being present after the mixture of immune serum complement and pneumococci had been suitably incubated and the organisms removed by centrifugalization. No such action was found in a control mixture containing complement and pneumococci without serum. No carbohydrate enzyme could be demonstrated, the reason given being that the capsules of the organisms were left intact. A lipolytic enzyme was also shown to be present. One of the conclusions drawn by the author was that the hæmolytic action of the endotoxin is hindered by the presence of oxygen. In this connexion it must be remembered that Avery and Neil showed in 1924 that the hæmolysin present in extracts from pneumococci could by exposure to air be oxidized to an inactive form. The author has produced insufficient evidence to prove his contentions.

As long ago as 1904 Rimpau showed that the action of immune serum on pneumococci was bacteriotropic in nature, resulting in increased phagocytosis, and that in this bacteriotropic action complement took no part. It has been pointed out by other workers that it is probable that these bacteriotropins act by neutralizing some substance on the surface of the pneumococcus—some substance associated with the capsular material and the specific soluble carbohydrate. In the light of work previously done, it is more likely that resistance to phagocytosis is associated more with the capsular substance than with endotoxins. There is no proof of the assertion made by the author that: "It is unquestionably the endotoxin in the organisms which protects them against lysis by the leucocytes and other phagocytes."

## ULTRA-VIOLET RADIATIONS.

THE superiority of the radiations from an arc between electrodes composed of tungsten, titanium and chromium over the simple tungsten arc and other sources of ultra-violet light used in ordinary phototherapeutic practice is the principal theme elaborated by Cooper and Roberts in "Photo-Activity and Therapy of the Tungsten-Titanium Arc".<sup>1</sup> The research described was instigated by the improvement effected by irradiation of an eye which, after extraction of a cataractous lens, had become complicated by iritis, enclysis and vitreous prolapse. Only one such ophthalmic treatment is mentioned, and the authors state that "unfortunately in the case of the eye referred to we had no bacteriological proof of the infection being present". This is surely a slender basis on which to erect claims as to the special value of the arc in ophthalmic treatment.

The brief clinical section of the book is more than unsatisfactory. Beneficial effects of the radiation on eczema, varicose ulcers, acne, chilblains, some anæmias and rheumatic conditions are described, and there is a section on the treatment of "General Debility". The value of phototherapeutics in treatment of these conditions is undoubted, but the authors' report gives a very amateurish impression, which is not lessened by the reproduction at length on page 61 of a testimonial from a layman, although

<sup>1</sup> "Research Work on the Pneumococci and Their Enzymes and Its Significance in Lobar Pneumonia", by A. Cowan Guthrie, M.B.; 1932. London: Baillière, Tindall and Cox. Royal 8vo., pp. 69, with eight plates. Price: 7s. 6d. net.

<sup>1</sup> "Studies in the Photo-Activity and Therapy of the Tungsten-Titanium Arc", by J. Burdon-Cooper, M.D., B.S., B.Sc., G.T.V.D.R., D.O., F.C.S., and A. Roberts, T.D., F.R.C.S.E., M.R.C.S.; 1931. Bristol: John Wright and Sons. Royal 8vo., pp. 85, with illustrations. Price: 10s. net.



it is interesting to learn that at least one man's golf is now improving.

The electrodes used were composed of "tungsten, titanium and chromium, the titanium content being between 14 and 2 per cent, and the tungsten about 98 per cent, with a small but definite addition of chromium" (page 83). Nowhere in the book is the composition given more exactly. Unfortunately, too, the experimental section of the book is marred by errors in physics, such as the statement on page 26 that "there is a levelling up of the velocities of the molecules in a gas suddenly subjected to pressure (those of high velocity losing and those of low velocity gaining, until the arrangement finally settles down to a uniform velocity)." Clerk Maxwell knew nothing of this!

In spite of these perversities, however, the authors do seem to have shown that a tungsten-titanium arc can exert bactericidal effects on *Bacillus coli* cultures through an ox-hide screen, "a circle of raw hide from an animal killed the same day, hair removed, inner surface still moist", thickness not stated. Whether other sources of ultra-violet light, such as the mercury lamp, will do this, was not directly tested. This is regrettable, as the bactericidal effect of the mercury lamp was examined through other filters. The key experiment capable of demonstrating the superiority of the titanium arc was thus omitted.

Spectrograms showing the transparency of ox-pelt, five-sixteenths of an inch in thickness, to visible and ultra-violet light up to 3,800 Angström units are given. These transparency experiments were suggested by the fact that the eye which had been improved was irradiated through the closed eyelids.

The only real evidence adduced for the superiority of the tungsten-titanium arc is theoretical. Spectrograms are given, and emission line-intensity tables are quoted from the American Bureau of Standards. From the latter and from the spectral richness of the compound arc a therapeutic advantage is to be expected. The experiments described, however, have not demonstrated this. It is unfortunate that ultra-violet radiations, so uniquely valuable in their sphere, have found such poor protagonists.

#### MARRIED LIFE.

IN THE MEDICAL JOURNAL OF AUSTRALIA of November 14, 1931, an article by R. L. Dickinson was discussed. Dickinson made an analysis of one thousand marriages from the physical point of view. He has now published an account of his studies in conjunction with L. Beam: "A Thousand Marriages: A Medical Study of Sex Adjustment."<sup>1</sup> This book is a detailed discussion of the investigations on which the previous article was based. Dignity is lent to the book by a foreword from the pen of Havelock Ellis. Ellis writes: "This first considerable medical analysis of marriage in its widely human relationship, here presented, concerns every physician who is called upon to give advice in matters of sex, in or out of marriage." He also states that: "Life must always be an art, but in no sphere is this more true than that of love and sex." In this regard we would reiterate the statement that sex must be considered in its proper relationship to the other factors which go to make married life happy and livable.

The authors divide their book into five parts. Part I is entitled "Sources, Methods, Theory, Norm". Part II deals with "The Beginning and the Extremes". In this part sections are devoted to brides, frigidity, passion and dyspareunia. Part III is entitled "The Affirmative". Here the sections are concerned with adjustment, fertility, widows and a control group. Part IV is "The Negative". In this part there are five sections: "Maladjustment", "Fear", "Substitution and Compensation", "The Conflict of

Education", "Separation and Divorce". Part V is entitled "Interpretation". In this section the authors discuss passion and frigidity and give a summary of the book.

Throughout the book the authors give detailed clinical histories of the sexual experiences of many of the persons with whom they have come in contact. As a book of reference for those who study sex problems this work will be useful. Its value to the general practitioner is doubtful.

#### LIGHTNING.

LIGHTNING, lightning-stroke and its treatment are fully dealt with by H. A. Spencer in the "Minor Monograph Series".<sup>2</sup>

Dr. Spencer has resided in the Eastern Transvaal for many years and has had many opportunities of studying the effects of lightning-stroke. Dry thunderstorms, accompanied by very vivid lightning, appear to be common in this part of the world during the summer months. The author graphically describes many of his personal experiences during these storms.

He deals in an interesting manner with the causes of lightning and with methods of insulation which may be adopted to render habitations safe in these areas. The effects of lightning-stroke vary in degree from sudden death at the time of the flash to various degrees of electrification and burning. The dangers associated with streams of hot air emanating from dwellings during a thunderstorm are pointed out and many illustrative episodes are described. The military bell tent appears to have an unsavoury reputation in this regard.

The book gives evidence of keen observation, it is simply written, in pleasing language, and as well as being an excellent account of the subject of its title, it throws a very interesting sidelight on the life of a country practitioner in South Africa.

The book can be highly recommended to those desirous of learning more about lightning and its baneful effects.

#### Notes on Books, Current Journals and New Appliances.

##### THE MEDICAL ANNUAL.

"THE MEDICAL ANNUAL" for 1932 is described as the jubilee volume.<sup>2</sup> Medical practitioners who have learned to appreciate this publication, and they are many, will congratulate the proprietors on the fiftieth birthday of this book. The publishers have marked the occasion by the inclusion of a special supplement containing all available portraits of past and present contributors. The picture gallery is most interesting and will be much appreciated. Following a review of the year's work in the treatment of disease there is the usual "Dictionary of Practical Medicine", by many contributors. It is quite unnecessary to describe any of the sections under this heading. The latest work on each subject is described and references are given. Medical practitioners who are not in the habit of buying this book are strongly advised to make its acquaintance. Once they have done this, they will acquire the "Medical Annual" habit.

<sup>1</sup> "Minor Monograph Series: Lightning, Lightning-Stroke and Its Treatment", by H. A. Spencer, M.R.C.S., L.R.C.P.; 1932. London: Baillière, Tindall and Cox. Crown 8vo., pp. 100. Price: 5s. net.

<sup>2</sup> "The Medical Annual: A Year Book of Treatment and Practitioner's Index", edited by C. F. Coombs, M.D., F.R.C.P., and A. R. Short, M.D., B.S., B.Sc., F.R.C.S.; Fiftieth Year; 1932. Bristol: John Wright and Sons, Limited. Demy 8vo., pp. 674, with illustrations. Price: 20s. net.

<sup>1</sup> "A Thousand Marriages: A Medical Study of Sex Adjustment", by R. L. Dickinson and L. Beam, with a foreword by Havelock Ellis; 1932. London: Williams and Norgate; Baillière, Tindall and Cox. Demy 8vo., pp. 507. Price: 21s. net.

# The Medical Journal of Australia

SATURDAY, AUGUST 27, 1932.

All articles submitted for publication in this journal should be typed with double or treble spacing. Carbon copies should not be sent. Authors are requested to avoid the use of abbreviations and not to underline either words or phrases.

References to articles and books should be carefully checked. In a reference the following information should be given without abbreviation: Initials of author, surname of author, full title of article, name of journal, volume, full date (month, day and year), number of the first page of the article. If a reference is made to an abstract of a paper, the name of the original journal, together with that of the journal in which the abstract has appeared, should be given with full date in each instance.

Authors who are not accustomed to preparing drawings or photographic prints for reproduction, are invited to seek the advice of the Editor.

## A FRONTIER MEDICAL SERVICE.

ONE of the tragedies of Australia is that by far the greater number of its inhabitants live in its cities and that these people know little and very often care less about those who live and die in remote parts of the continent—in the “back of beyond”. It is only when some aeroplane with its crew or when a lonely aviator is lost that the average person looks for a map to discover the whereabouts of some place of which he or she has never heard. Australia owes much of its progress to the men and women (the women are too often forgotten) who, endowed with courage and determination, were prepared to face hardship, discomfort and loneliness in the backblocks. Australia must therefore owe something to those who have followed in the footsteps of the pioneers and who are faced by many difficulties common to the early days.

Among the chief difficulties are those connected with medical treatment and transport of the sick. Circumstances, of course, have changed. The cumbersome coach, with its days of monotony, gave way in not far distant places to the railway, and the aeroplane has solved the problem of transport in all areas. In THE MEDICAL JOURNAL OF AUSTRALIA of November 12, 1927, an account was given of the

scheme of medical service for “inland” Australia inaugurated by the Australian Inland Mission under the auspices of the Presbyterian Church of Australia, and in this issue there appears an article compiled by Dr. G. Simpson and the Reverend John Flynn on the Aerial Medical Service organized by the Australian Inland Mission. The objects of “The Aerial Medical Services of Australia” are:

1. To promote throughout the sparsely settled areas of Australia: (a) The establishment of aerial medical service bases; (b) the multiplication of landing grounds, properly marked and duly charted; (c) the formation and training of frontier radio clubs, where “wire” facilities are lacking; (d) the organization of the necessary service patrols, to insure continuous efficiency throughout the entire system; (e) the provision, at strategic centres, of special equipment, to be maintained always ready for the use of search parties when persons are lost.

2. Where locally desired, to assist kindred services within the areas influenced, with a view to the evolution of district medical service associations, which might, ultimately, take over control of local sections of the Aerial Medical Services.

3. To provide opportunities for post-graduate study for doctors who have served in outposts associated with the Aerial Medical Services.

4. To assist in creating adequate bureaux of information about the isolated areas of Australia.

5. To establish and to administer development funds necessary for the attainment of the above objectives.

How far the Australian Inland Mission has succeeded in its efforts may be judged by perusal of the article by Dr. Simpson and Mr. Flynn and by reading “Flynn of the Inland”, a remarkable book by Ion L. Idriess.<sup>1</sup>

The Australian Inland Mission has shown that it is possible to provide a useful medical service for the isolated people of the sparsely populated parts of the “inland”. It has undertaken a national work and has carried it out successfully. The time has come when the work should be extended and made a national enterprise. The Australian Inland Mission is prepared to cooperate in a suitably planned scheme to achieve this end. In this connexion several points may be discussed. In the first place, some of the towns in the far north which have had resident medical practitioners, have for various reasons been deserted by them. Others have never been large enough or prosperous enough to attract a medical practitioner. Some of these

<sup>1</sup> “Flynn of the Inland”, by I. L. Idriess, with Forewords by S. Kidman and R. G. Macintyre; 1932. Australia: Angus and Robertson, Limited. Crown 8vo., pp. 315. Price: 6s. net.

towns have hospitals run by a resident nurse, who may or may not be certificated. Others have no hospitals. In certain places the Australian Inland Mission has established hospitals which are in the care of two certificated nurses. Secondly, the area covered by a national frontier service should include Central Australia, Northern Australia and northern parts of Western Australia, as well as parts of Queensland. If this large area were not included, the service would not reach all the people for whom it would be intended, and the number of medical practitioners in the service would be too small. If there were only a small number of medical practitioners in the service, it would be impossible to arrange regular study leave for its officers. The isolation of medical practitioners in these areas and the small amount of clinical work done by them make it essential that they should, at intervals of not more than two years, preferably one year, undergo a course of post-graduate study. It must also be recognized that there are in the far north certain areas staffed by medical practitioners who are either engaged in private practice or who hold government appointments. There would be no need, nor would it be desirable, to disturb arrangements such as these. Coordination of effort must be the objective and not necessarily uniformity.

If a frontier national medical service is to be organized, it must be controlled by a central body of persons who understand the conditions of life in the inland districts, who know something of the mental outlook of the people living there, and who are qualified to make a selection from applicants for admission to the medical service. The controlling body should include representatives of the Federal Government and of the State Governments concerned. It should not be wholly governmental. Representatives of the medical profession (preferably of the British Medical Association) should be included, as well as representatives of the nursing profession. Since the country in question is given up largely to cattle and sheep stations, there should be some representation of employers and employees. During the early stages, at least, the Australian Inland Mission should be represented. There will be no solution of the medical problems of the interior until they are tackled on a broad basis,

from the national point of view and from one devoid of any feeling of class distinction. It is not fair that the Australian Inland Mission should "carry the baby" for all time. This is a matter that should be considered at a Premiers' Conference. Since it is unlikely that any of the governments will introduce the subject, it should be brought before one or more of them by such bodies as the Australian Inland Mission and the Federal Committee of the British Medical Association acting in conjunction.

### Current Comment.

#### SEQUELS OF CEREBRAL INJURIES.

THE immediate anxieties attendant upon head injuries are well known. Now that rapid modern transport has invaded all civilized countries, all practitioners of medicine are called upon to assume the responsibility of treating patients with head injuries. The subject has been dealt with recently in these pages, and attention has been drawn to the useful discussion at the last Australasian Medical Congress.

When the patient leaves his bed, his troubles are often not over, and difficult problems are presented both to the doctor and jurist. The patient may, of course, have suffered some irreparable and more or less obvious damage, such as cranial nerve palsy. But more obscure and subtle are certain other sequels. These are briefly but helpfully described in an article by C. P. Symonds, based upon a paper read at the International Neurological Congress at Berne.<sup>1</sup>

One of the most prominent symptoms observed in those who have suffered a severe cerebral injury is a general incapacity. The patient is neurasthenic, his power of concentration is much impaired, and his executive ability is definitely lowered. This state of affairs may demand a prolonged convalescence, and, indeed, full working capacity may never be regained. This is, as Symonds points out, related to some extent to the degree of traumatic stupor from which the patient suffers at the outset. This term is used to denote the state of clouded consciousness observed in these patients, without signs of focal damage, and often with excitement or delirium. The degree of stupor is not of necessity dependent upon the intracranial pressure, for severe stupor may exist with a normal pressure; nor does it bear any relation to meningeal bleeding. Symonds subscribes to the view that the cause is direct neural injury with later reactive stages, such as degeneration of nerve cells and glial proliferation. A raised intracranial pressure should be dealt with if present, but otherwise the only treatment is prolonged rest with sedatives.

<sup>1</sup> *The Lancet*, April 16, 1932.



Later symptoms, such as diplopia, vertigo and headache, are also considered. The first of these is probably related to injury of the brain stem. Symonds also relates vertigo to the same cause, following the hypothesis of Duret, whose observations show that the walls of the ventricles, especially in the region of the aqueduct and the fourth ventricle, suffer severely in cerebral injuries. Vertigo is so common a symptom in these patients that it demands careful attention. It is, as many have observed, unassociated with aural phenomena, but is particularly induced by rapid movements of the head. Too often these patients are considered to be suffering from a neurosis, a view which needs modification in the light of the probable pathology of this condition.

Headache is equally common, and Symonds describes three varieties. The first is of the "psychogenic" order, a feeling of numbness or pressure, intensified by all mental stimuli. This, he suggests, represents a reflection in consciousness of the general cerebral incapacity. The second is more acute and localized, and is probably of the type described by Penfield and others, due to some loculation in the cerebro-spinal fluid system. It has been relieved by the admission of air to the subarachnoid space. The third type of headache is inconstant, but severe and bursting, and associated with vomiting. It is thought to be due to intermittent hydrocephalus, and may be relieved by repeated lumbar puncture.

Symonds also refers to that curious group of sequelæ, the delayed group, where symptoms occur after a latent period, and mentions the suggestion that these are due to a gradually developing reaction of the cerebral tissues to areas of traumatic necrosis.

There is, of course, nothing new or provocative in this account of cerebral states only too often seen in the victims of accidents. But a clear recognition of the common sequels and of their importance is very necessary. Still more vital is it to have some working hypothesis of their pathology, for without this we are no more than mere empirics.

#### "AVERTIN."

SOME weeks ago a leading article was published in this journal on "Avertin". This article was intended as a warning against the use of the drug as anything more than a basal anæsthetic. It was also intended as a plea for the recording of fatalities and for the performance of *post mortem* examination whenever possible. That a warning is necessary is undoubted. Some of the readers of this journal either could or would see nothing in the article but an attack on "Avertin". The attack, if attack there was, was against the careless and indiscriminate use of the drug. The main objection to the use of "Avertin" as a self-sufficient or even as a basal anæsthetic is that, once the drug has been injected into the rectum, the anæsthetist loses control of

anæsthesia. In this connexion it is interesting to read a communication from W. P. Kennedy.<sup>1</sup>

Kennedy refers to results of animal and clinical experiments published by Killian, 1931, on the possibility of interrupting "Avertin" narcosis by means of "Coramine". "Coramine" is pyridine- $\beta$ -carbonic acid diethylamide. Martindale and Westcott state that it is used "in shock, heart asthenia following infectious diseases (*pneumonia et cetera*), arteriosclerosis, renal affections, bronchial asthma, emphysema, poisoning through narcotics, and asphyxia of the new-born". It is described by them as a substitute for camphor, strychnine and caffeine, since in collapse it has a stimulating action on the central nervous system and on the circulatory and respiratory apparatus. Kennedy adopted the procedure outlined by Killian, but he used smaller doses of "Coramine", since complete interruption of anæsthesia was not desired. The usual dose given was two to three cubic centimetres; the intramuscular route was used. The dose mentioned by Martindale and Westcott is one to two cubic centimetres of the liquid with a little water for oral administration, and one to two ampoules, each containing 1.1 cubic centimetres, for hypodermic, intramuscular or intravenous administration. Kennedy found that administration of the drug was followed by rapid improvement in colour and by deepening and acceleration of the depressed respirations. The slack jaw muscles stiffened and the jaw no longer had to be supported. At the same time the blood pressure rose and the pulse became slower and stronger. In no instance did the drug lessen the anæsthesia to a degree sufficient to interfere with the operation in progress or about to be started. The patients appeared to wake rather earlier than usual, but Kennedy has no exact data on this point. He gives short notes of two cases in which use of the intravenous route was considered necessary. They cannot fail to convince the reader of the value of the drug. Although Kennedy made no attempt to restore consciousness rapidly, he states that his findings confirm Killian's conclusions that "Coramine" is an effective agent in counteracting and interrupting the cardio-respiratory depression of "Avertin" anæsthesia.

Kennedy's conclusions should be widely known. "Coramine" should be at hand whenever "Avertin" is used. The experience of Killian and of Kennedy, however, must not be put forward as an excuse for using "Avertin" on occasions when it would not be used if "Coramine" were not available. Deny it who may, there is still need for the utmost caution in using "Avertin". In April, 1930, in a discussion on "Avertin" in these columns, the following words were used: "It will be wisest at the present time . . . to regard 'Avertin' as suitable for premedication. It is much better to widen the indications for its use in the light of experience than to cut them down in the shadow of disaster." Disasters have happened and are still happening. Our statement of April, 1930, need not, therefore, be altered.

<sup>1</sup> The Lancet, May 28, 1932.

## Abstracts from Current Medical Literature.

### PHYSIOLOGY.

#### Variations in the Leucocyte Count.

H. E. MARTIN (*Journal of Physiology*, June, 1932) has shown that the diurnal variation in the leucocyte counts of humans is least when the subject is in a state approximating complete physiological rest. Mental or physical activity causes a rise in the count and there is normally a rise in the late afternoon or early evening. Exercise produces increases varying from 15% to 48% of the resting value; an ensuing rest of about thirty minutes results in a fall in the leucocyte count to the resting level. Further exercise produces a rise similar in degree to that first observed. The lymphocytes show the greatest increase. The hypodermic injection of adrenaline is followed by a leucocytosis in which all types of cell show an increase, but the increases in lymphocytes is again most marked. Possibly the leucocytosis following exercise is the result of increased secretion of adrenaline. The lymphocytes are probably derived from lymph glands which contract under the influence of adrenaline, and the glandular cells may be washed out of the bone marrow as a result of an increased blood flow due to the effect of adrenaline on the heart or to the exercise.

#### Muscular Work and Protein Metabolism.

H. E. C. WILSON (*Journal of Physiology*, May, 1932) has investigated the excretion of sulphur and nitrogen in the urine of human subjects during periods of exercise repeated for several days. An initial increase in the output of both elements is followed by a decreased excretion. The magnitude of the increase appears to have no relation to the amount of work done. The quality of the protein ingested during the experimental period seems to influence the amount of sulphur and nitrogen excreted and their relative proportions. The author suggests that these changes are the result of an increase in the rate of metabolism of food protein and are not due to alteration in endogenous metabolic processes.

#### Gastric Secretion and the Carbon Dioxide Content of the Blood.

J. S. L. BROWNE and A. M. VINEBERG (*Journal of Physiology*, July, 1932) find that the gastric secretion which is normally produced in dogs by vagal stimulation, is inhibited by hyperventilation of the lungs. If the carbon dioxide content of the air entering the lungs is increased to 5% or more, the secretion is restored, even though the hyperventilation still continue. The secretion can also be inhibited by the intravenous injection of hydrochloric or lactic acid, but it would seem

that this effect is conditioned by the ensuing changes in the carbon dioxide content of the blood rather than by alteration in the pH of that fluid. In general the gastric secretion ceases when the carbon dioxide content of the arterial plasma falls to thirty volumes per centum or lower. Secretion in response to histamine injections is also inhibited by the production of acidosis prior to the commencement of secretion, but is not affected either by acidosis or by hyperventilation occurring after the secretion has been established.

#### The Function of the Adrenal Glands.

S. W. BRITTON (*The American Journal of Physiology*, June, 1932) has investigated the function of the adrenal glands. Adrenalectomy has profound effects on carbohydrate metabolism of an animal and these effects are primarily responsible for its death. Blood glucose and liver glycogen are chiefly affected, being reduced considerably below normal levels. The author finds that muscle glycogen is consistently decreased and blood lactate increased. The glycogen of heart muscle is not reduced. After pancreatectomy and hepatectomy carbohydrate metabolism was affected to no greater extent than in experimental adrenal insufficiency. The author found that the glycogenic and glycaemic changes occurring after complete adrenalectomy were not observed when the adrenal medulla alone was extirpated. He describes the recovery of animals following the administration of cortico-adrenal extract and lays stress on the extreme fluctuations in blood sugar and liver glycogen observed during the development of and recovery from adrenal insufficiency. He concludes that the cortico-adrenal tissues (and their pertinent hormone) are primarily concerned in the control of carbohydrate metabolism in the body. Since the cortex represents that part of the organs which is essential to life, the regulation of carbohydrate metabolism may be considered the principal function of the adrenal glands.

#### Intestinal Obstruction.

R. C. HERRIN and W. J. MEEK (*The American Journal of Physiology*, June, 1932) state that they have shown that in dogs distension of a balloon in a Thiry or Thiry-Vella fistula of the ileum induces all the usual symptoms of acute intestinal obstruction. They and others attributed the results to disturbances in the salt and water content of the body. They point out that a series of blood volume determinations made by them substantiates this view. If a strong salt solution is added through an ileal fistula, the animal may stand distension of a Thiry loop with impunity. Later, the animal succumbs if the salt is withdrawn. The mere decrease in plasma volume is not fatal if the salt content remains normal. In the authors' experiments there was no accumulation of intestinal contents nor was

there any sign of autolysis or gangrene in the loops. There was no evidence in support of the view that an intoxication, bacterial or protozoic, was the cause of the acute condition. That there is a nervous factor is shown by the finding that animals with denervated loops withstand the pressure of distension indefinitely. Their resistance depends on their undiminished intake of water and salt. The authors point out that distension stimulates a definite secretion of intestinal juice, rich in salt, which either accumulates in the gut and may be removed by vomiting, or, in the presence of a fistula, drains to the exterior. In either circumstance the result is dehydration or dechlorination of the animal. The loss is not replaced, for the animal soon ceases to eat and the fluid intake is correspondingly reduced. That anorexia is due to afferent sensations from the distended regions is shown by the fact that animals with denervated loops continue to take food and retain their body weight. Distension is thus a primary factor in the fatal outcome, for it directly stimulates the loss of body fluids and salt and indirectly diminishes the intake.

### BIOLOGICAL CHEMISTRY.

#### Nitrogen, Calcium and Phosphorus Metabolism.

RUTH KERN, MARY F. MONTGOMERY and EUGENE U. STILL (*Journal of Biological Chemistry*, October, 1931) undertook studies to determine the effect of varying doses of irradiated ergosterol upon the rate of growth and upon the nitrogen, calcium and phosphorus metabolism of young rats taking a normal diet, also to observe whether the solvent in which the ergosterol is irradiated bears any relationship to the toxicity of the irradiated product, or whether toxicity runs parallel with the vitamin content of the sample regardless of the mode of irradiation. They found that irradiated ergosterol in large doses increased the absorption of calcium from the intestine and decreased the excretion of calcium in the faeces. The excretion of calcium in the urine was greatly increased. To a less degree a diminished faecal elimination of phosphorus was also found. In the kidneys of growing rats receiving daily large doses of irradiated ergosterol there was found macroscopic and microscopic evidence of an accumulation of much calcium. Chemical analyses of these organs revealed the deposition to be more pronounced in the female than in the male. The nitrogen excreted in the urine seemed to have been entirely within the normal range, being affected mainly by the level of the food intake. Ergosterol irradiated in alcohol was found to produce greater disturbances in the calcium metabolism of growing rats than either ergosterol irradiated in ether or irradiated dry, on the basis both of actual weight of ergosterol fed and

of the vitamin content of the samples. The authors believe that the medium in which the ergosterol is irradiated plays an important part in the development of toxicity.

#### The Occurrence of Copper and Manganese in Preparations of Iron.

J. H. SHELDON AND H. RAMAGE (*The Quarterly Journal of Medicine*, January, 1932) have undertaken a spectrographic examination of sixty-five therapeutic preparations of iron and have shown that manganese is a constant impurity, often being present in considerable amount. Copper was found to be absent from one-fifth of the specimens, and its distribution in the remainder was very irregular. The lines in the spectroscopy caused by the alkali metals and the alkaline earths were disregarded, though sodium, potassium and calcium were almost invariably present. Traces of lead were found in five specimens, and in one sample the surprisingly large amount of 0.125% was present. The authors point out that this finding, though a solitary one, indicates that if it is intended to treat a patient for any considerable length of time by the same sample of a particular preparation, the preparation should be examined for lead. The authors conclude that further investigation is needed into the extent to which the value of iron, when given therapeutically in large doses, is dependent on the presence of metallic impurities.

#### Blood Cholesterol in Childhood.

KATHLEEN M. WARD (*Archives of Diseases in Childhood*, December, 1931) has estimated the blood cholesterol of children of both sexes between the ages of six and thirteen. The children taken to represent the normal were sound healthy children from an orphanage. The average percentage of blood cholesterol in healthy boys was found to increase as the age increased and the percentage in individual boys did not differ greatly from the average for that age. There was a steady and progressive rise towards puberty with a rather more rapid increase from the age of nine onwards. From nine to ten the rise was pronounced, but a more even level was found between ten and thirteen. The average blood cholesterol of healthy girls was found to increase much less with age than that of healthy boys and the percentage of cholesterol in individual cases often departed widely from the average for that age. To determine whether there was any abnormality in the cholesterol content of the blood during the course of juvenile rheumatism estimations were made in cases selected from all stages of the disease. In acute juvenile rheumatism the average percentage of the cholesterol in the blood was found to be normal, but in chronic rheumatism it showed a definite tendency to be higher than normal. The author suggests that this abnormally high level is related to the dis-

ordered growth which frequently attends chronic juvenile rheumatism. Estimations of the blood cholesterol made during the course of the parenchymatous type of chronic nephritis in children showed that the blood cholesterol rose as in adults. The blood cholesterol was found to be normal in idiopathic asthma and in diabetes controlled by insulin.

#### Blood Urea in Diabetic Coma.

ALEXANDER LYALL AND A. GRIEG ANDERSON (*The Quarterly Journal of Medicine*, April, 1932) have studied twenty-five cases of diabetic coma in seventeen patients over a period of five years. Every patient had sugar and ketones in the urine. Blood sugar and blood urea values are given in detail. Considerable variation in the blood urea values occurred during the early stages of active and effective insulin therapy, and in three cases an increase was observed coincident with a decrease in the blood sugar value and with improvement in the general condition of the patient. In all three cases, however, the blood urea began to fall within thirty-six hours. The authors believe that though a moderate retention of nitrogen in the blood in the early stages of coma is not necessarily of grave significance, considerable prognostic importance can be placed on retention of any pronounced degree, and the chances of recovery with suitable treatment are relatively good when the blood-urea is normal or only moderately increased. They are correspondingly bad when the blood urea value exceeds 100 milligrammes per centum. The authors conclude that dehydration and excessive nitrogen metabolism are minor factors in the production of increase in the blood urea in diabetic coma, but that when renal involvement supervenes, nitrogen retention results.

#### Nutritional Anæmia in the Rat.

J. M. ORTEN, F. A. UNDERHILL AND R. C. LEWIS (*Journal of Biological Chemistry*, April, 1932) have studied the preventive action of certain metals, including those they had already found to be ineffective, in correcting nutritional anæmia. They have tried to determine whether the failure of these metals to cause an increase of hæmoglobin in anæmic animals could have been due to some toxic effect of the comparatively high levels at which the metals were fed. Experimental details are given in full. Male albino rats were used throughout. The authors come to the following conclusions: (i) Inorganic iron failed to prevent the development of a nutritional anæmia in the rat on a milk diet, whereas iron supplemented by copper permitted the maintenance of an approximately normal hæmoglobin value. (ii) Iron supplemented by manganese failed to prevent the development of nutritional anæmia. (iii) A mixture of manganese, cobalt, nickel and zinc supplementing iron had no prophylactic action in nutri-

tional anæmia, while the same mixture plus copper prevented a decrease in the hæmoglobin level. (iv) No toxic effect of manganese, cobalt, nickel or zinc was observed. (v) Of all the metals studied copper alone had the ability to supplement iron in preventing the nutritional anæmia of the rat.

#### The Pituitary and the Thyroid.

J. A. SCHOCKAERT AND G. L. FOSTER (*Journal of Biological Chemistry*, February, 1932) have published results obtained when young male ducks are treated with a fresh saline emulsion of beef anterior pituitary. This material was injected and was found to induce a rapid drop in the total iodine content of the thyroid gland. The total iodine content of the thyroid gland was as low after one week as after five weeks of treatment, but the percentage of iodine dropped more and more since the glands underwent hypertrophy and hyperplasia. The anterior pituitary fraction which contains the growth hormone, was also found to possess this thyrotropic action, while the luteinizing hormones, even with higher dosages, did not influence the percentage of iodine in the thyroid except in one instance. The authors are unable to explain this exception, as the thyroid showed neither hypertrophy nor hyperplasia. The authors conclude that the thyroid hypertrophy and hyperplasia induced with anterior pituitary suspensions can be compared chemically as well as histologically with the hyperplasia observed in human hyperthyroidism and exophthalmic goitre.

#### Proteinuria in Nephritis.

P. M. KERRIDGE (*The Quarterly Journal of Medicine*, January, 1932) has shown that the concentration of protein in the urine of patients suffering from nephritis varies during the day. The protein concentrations were very much higher in the evening and early morning specimens than in the others, and a moderate increase in the protein concentration occurred in the middle of each day in nephritic patients. The reverse is true of orthostatic albuminuria. The total amount of protein lost was found to be greater by day than by night, owing to the greater relative increase in the volume of urine passed during the day. The effects of getting up from bed, of diuretics and of infections, were found to cause large increases in protein concentration without change in the total amount of protein lost, on account of the simultaneous and inversely proportioned decrease in urine volume. The author suggests that the total protein loss per twenty-four hours is a more valuable clinical guide than the protein concentration in a single specimen of urine, and also that when a twenty-four hour specimen is not available, the concentration of protein in an early morning specimen will give more useful information than that in a specimen passed during the day.



## British Medical Association News.

### SCIENTIFIC.

A MEETING OF THE QUEENSLAND BRANCH OF THE BRITISH MEDICAL ASSOCIATION was held at the B.M.A. Building, Adelaide Street, Brisbane, on July 1, 1932, Dr. E. S. MEYERS, the President, in the chair.

#### Acute Mastoiditis.

Dr. WALTER CROSSE read a paper entitled: "Acute Mastoiditis" (see page 253).

Dr. W. N. ROBERTSON congratulated Dr. Crosse on his very practical and precise way of presenting his paper. He had stressed the most important points—prevention and early operation, which was much better than late operation. Frequently in the old days mastoiditis had occurred in children; probably children had not had their adenoids so zealously removed as at present, and the number of patients with mastoiditis in hospital now was not nearly so great as in the early days of Dr. Robertson's experience. There had then been ten to a dozen patients as against one today. The general practitioner should examine the ears in the exanthemata, and particularly in influenzal patients, every day, and so "get in first". By daily examination and the finding of any infection one could puncture the drum head in the early stages and so prevent a mastoiditis developing. Dr. Robertson said he had many queer cases. He referred to a patient whose drum head was punctured, but the condition did not settle down in a week. The mastoid was opened up and a condition was found that appeared to be of many years' standing. The patient was questioned later and it was found that she had suffered from typhoid fever seventeen years previously and had noticed creaking and discomfort in the ear since then. That had probably been the commencement of the trouble.

Dr. Robertson quoted another case in which an acute mastoiditis had seemed to settle down. Suddenly one night the patient complained of acute pain. Next day the mastoid was opened and Dr. Robertson found the upper half of the mastoid antrum perfectly healthy. The drainage had dried up the upper part and the lower part had suddenly lit up and caused the pain. Dr. Robertson considered Dr. Crosse's paper would be of great use to everyone.

Dr. ERNEST CULPIN thanked Dr. Crosse for his paper. The subject was a most intricate one to talk about, and to cover all points would take a lot of time. Dr. Culpin felt that he would like Dr. Crosse to give some definition of mastoiditis. It was not an acute bone disease. The mastoid had been compared by Heath to the appendix. Dr. Culpin compared it to the accessory sinuses, which were practically diverticula of the nasal chambers. If there were inflammation in the middle ear, one would undoubtedly have inflammation of the membrane lining the mastoid cells, in other words, mastoiditis. A large number of patients so affected recovered.

There were two statements Dr. Culpin would like to question. First, in regard to the differential diagnosis between furunculosis and mastoiditis. Dr. Crosse said that in furunculosis deafness did not develop unless the external auditory meatus was occluded by swelling. Dr. Culpin did not agree with this, as he had often found dulness of hearing, probably caused by hyperæmia induced in the *membrana tympani* and perhaps the middle ear. The presence of deafness with a furunculosis in the auditory meatus did not mean that the condition was a mastoiditis. Secondly, in regard to the case quoted by Dr. Crosse, of the rupture of the drum when the man was pushed into the water, the question was, did the man sustain a rupture of the drum? He had a coryza at the time, which probably caused a discharge from the ear the day after he had fallen into the water. The *otitis media* might have arisen from a nasal infection through the water or through some foreign material.

In regard to the question of paracentesis, Dr. Crosse stressed the point of incising the drum membrane when

it was bulging. Dr. Culpin thought it wrong to incise the membrane if it were somewhat congested only. He quoted reports from an American medical journal which pointed out that the morbidity in such cases was high. If the drum was bulging, incision was necessary. If *otitis media* was present, there must also be mastoiditis. Treatment producing very great benefit in these cases was the use of a medicated inhalant containing menthol, oil of eucalyptus, oil of pine and friar's balsam. This should be used from hot water every two hours at least. If it were to do any good. Dr. Culpin wished to stress the point of prevention of any secondary infection from unnecessary paracentesis of the drum membrane. It was quite a common practice in acute *otitis media* with profuse discharge to give peroxide of hydrogen for dropping into the ear. This was wrong; the one golden rule to observe was to keep the ear clean and dry, and if peroxide of hydrogen and wool were used in the ear, prolongation of the disease and the growth of organisms with warmth and moisture was encouraged. Glycerine and carbolic drops were simple and useful. The essential point in early mastoiditis was to promote drainage. This could be done by the use of a medicated vapour and inflation of the middle ear, preferably with a catheter. After this the middle ear was cleaned and dried and a gauze wick was inserted. Dr. Culpin stressed the necessity for the removal of adenoids in acute *otitis media*. He agreed with Dr. Crosse about the danger from blowing. Inflation by means of a catheter was preferable to politizerization when it could be carried out.

Dr. J. LOCKHART GIBSON said he had listened with great pleasure to Dr. Crosse's paper. It was very complete, except in one particular. He was sorry that the need for daily politizerization after incision of the drum membrane, and generally in the case of otorrhœa, had not been insisted upon. It was, of course, difficult in very young children. Free drainage was most important, and daily politizerization helped to make this thorough. The incision in the drum membrane should be kept open or reopened until after all discharge had ceased. Politizerization was simpler, better, and more suitable for daily application than catheterization. He was sure that when he did ear and nose work he had prevented many cases of acute mastoiditis by strict adherence to early incision and daily politizerization. He had never seen harm done by incising a drum membrane. As William Macewen had shown, the mastoid antrum was situated at a higher level than the middle ear and drained into it. Politizerization in the presence of a perforation of the drum membrane aspirated and emptied the mastoid antrum very thoroughly. Catheterization had, of course, its own place. He had learnt it in fact from Urbantschitsch in Vienna, who practised it only before he learnt "*nach meiner Verfahren*" from Politzer.

Dr. S. F. McDONALD considered that Dr. Crosse's paper was one very necessary to the general practitioner. It was eminently practical and everyone should hear or read it; its simplicity and clearness about different points were most useful to the young practitioner. The great majority of the patients whom Dr. Crosse had seen were seen by him long after the time when they should have been seen by a specialist or by someone with a certain amount of judgement. Dr. McDonald thought that every febrile child should have its ears examined every day, particularly with the present instruments in use, and any general practitioner should be able to open a drum. The fact that the drum was opened did not mean that all treatment was over; the dressing of the ear was just as important as the dressing of a wound in any major operation. In children there was the danger of a mastoiditis going on to septicæmia or even meningitis, and this could happen even in children who were well looked after. In a case of mastoiditis which was apparently doing very well, and yet the child was not improving, meningitis should always be looked for. Lumbar puncture was not dangerous if only a small amount of fluid was drawn off, and it would give a definite diagnosis.

Dr. McDonald mentioned a case in which the direction of spread of infection had been reversed; the patient had a pneumococcal basal meningitis, then a mastoiditis had

developed, and finally a middle ear infection. The cerebrospinal fluid had been clear; the pus had tracked backwards from the base of the brain to the mastoid and the middle ear.

Had Dr. Crosse used the antiviral compounds in dressings of the acute middle ear? The "Glaxo" and Eli Lilly preparations were recommended and some of them acted well in cutaneous conditions. Could anything be done to dressings of the mastoid to make the condition less painful?

Dr. M. GEANEY thanked Dr. Crosse for his very excellent paper. With regard to deafness in furunculosis, he had found deafness sometimes when the walls were not together and the drum could be seen. In one case the drum membrane had appeared inflamed also. He agreed with Dr. Culpin that medications for nasal shrinkage should be used frequently, if at all, and probably a steam tent was the most suitable. Dr. Geaney had been struck with the remarkable amount of pus found at operation in some of Dr. Crosse's cases, that had not seemed to be very acute, though profuse discharge was present.

Dr. Geaney had dressed a moderate number of mastoids, and though the dressings were very painful, there was one less painful method. At the first dressing a lot of blood clot was found. If the wound were dressed very carefully at the time of operation, and the gauze folded carefully and neatly, it could be removed easily with no knots, and the pain was minimized.

How did the air cells of the mastoid communicate? Was it by lymph channels? At operation some air cells would be noticed full of pus, while others were not. Bulging of the mucous membrane showed that tension was present.

Dr. F. S. MEADE thanked Dr. Crosse for his paper. He had covered the ground very well and dealt with the salient points in a capable manner. In regard to prophylaxis, it was the practice at the Children's Hospital to examine the ears of febrile children; if any bulging of the drum was present, the drum was incised. The total result was that there were practically no cases of acute mastoiditis occurring at the hospital. These patients, whose drums were incised in hospital and who then came to the out-patient department, seemed to recover fairly well, and there were not many chronic cases. Dr. Meade made a practice of politizerization in children and used the method fairly often, at least every second day; it seemed to answer fairly well. Dr. Crosse had mentioned the nipple perforation; this was well recognized in the attic or posterior segment in children; the *membrana tympani* was nearly horizontal in young children, and most infection passing from the nose and throat to the ear was epitympanic, in other words, located in the attic to begin with. In the child the mucous lining of the middle ear was much weaker than in the adult, and therefore the time of perforation was longer than in the adult. Also the Eustachian tube was wider and some of the pus escaped. There was not, therefore, the same tendency to acute rupture as in the adult. Dr. Meade inquired whether Dr. Crosse had done anything with regard to the bacteriology in these cases? A hypodermic syringe could be used to draw off the fluid. Generally a streptococcus was found, sometimes a diplococcus which might resemble the Type III pneumococcus or the streptococcus, and which was occasionally in chains. It had a voluminous capsule with viscid material on it which gave the discharge its viscid character. This discharge might apparently clear up, the patients complaining only of deafness which increased, and the whole condition would resemble a catarrh, but, unlike ordinary catarrh, the cases would not respond to politizerization. The patient would complain of a peculiar feeling on one side of the head and in a few weeks a catastrophe might occur—either a lateral sinus thrombosis or meningitis, or other intracranial complication. Had Dr. Crosse seen any of these cases? The character of the infecting organism appeared to vary in different localities. The *Streptococcus hemolyticus* was not much seen in Vienna until lately. On the other hand, the Americans had not seen much infection by the *Diplococcus capsulatus*, whereas this was quite prevalent in Vienna.

Dr. AINSLIE CLOWES thanked Dr. Crosse for his excellent paper. There was undoubtedly a difficulty at times in distinguishing between furunculosis of the posterior meatal wall with accompanying post-auricular cellulitis, and mastoiditis. In such cases a radiogram should help considerably in the diagnosis. It must not be forgotten that the two conditions might coexist. In performing myringotomy the incision should be made from below upwards, as stressed by Dr. Crosse. In some cases it was advantageous to extend the incision upwards through the posterior fold and Shrapnel's membrane, even into the postero-superior meatal wall. Such an incision provided better drainage in attic suppuration. The attic contained the bulk of the ossicles, and, in addition, folds of mucous membrane which, when they became swollen and congested, effectually shut off the attic from the lower tympanic antrum below. The usual myringotomy incision, extending upward to the level of the posterior fold, was inadequate for efficient drainage of the attic. He had seen cases of acute zygomatic mastoiditis with a tender fluctuating swelling above and anterior to the auricle, in which the drum membrane was almost normal in appearance. After myringotomy Dr. Clowes said he always washed out the blood clot in an attempt to prevent premature closure of the incision. Regarding inflation, he considered politizerization was the only method to be used in young children, but in his opinion inflation by means of the Eustachian catheter was a far superior method in the treatment of older children and adults. In acute conditions of the middle ear there was always more or less congestion of the tubal mucosa, causing obstruction to the air current. This obstruction could be overcome more readily by the catheter method, for the air current could be directed accurately to the ear under observation, whereas in the Politzer method the air current naturally took the line of least resistance, through the healthy tube, in unilateral infection.

Dr. H. HORN said he had been waiting to hear stressed the treatment of those patients with influenza who complained of a little deafness and fullness in the head, the prodromal symptoms of an acute otitis. He used politizerization and catheterization. Dr. Horn thanked Dr. Crosse for his paper.

Dr. ELLIS MURPHY thanked Dr. Crosse for his paper. It had been pointed out that many of these infections were streptococcal. The *Guy's Hospital Reports* had contained accounts of the use of antistreptococcal serum in these cases. Early puncture of the *membrana tympani* had been performed, and in all streptococcal infections serum had been given immediately. The results showed that there were fewer complications afterwards and the percentage of morbidity had been decreased.

Dr. Crosse thanked the members for the reception of his paper. In reply to Dr. Robertson, he said that acute exacerbations of a chronic mastoiditis were always an indication for mastoidectomy, as it showed there was a further extension of infection.

In reply to Dr. Culpin, Dr. Crosse said that mastoiditis commenced first as an inflammatory condition of the lining of the mastoid antrum and cells, to be followed later with a cutting off of the blood supply from the bone and consequent necrosis. Many likened it to an osteomyelitis; it was generally regarded as an osteomyelitis. With regard to deafness in furunculosis, he had not seen many cases in which any chink was left at all, where deafness occurred. Deafness would probably occur when the inflammation had extended to the drum (myringitis) and naturally deafness would then be present. The only way to make a diagnosis in a case of furunculosis in conjunction with an otitis was to give an anæsthetic and push the speculum well down beyond the swelling. A furuncle might be secondary to an *otitis media*. The man whose drum was ruptured had had no sudden pain, and it was doubtful whether he had injured the drum or whether the water had gone up the Eustachian tube; he had an acute rhinitis at the time he fell into the water. If the drum had ruptured he would have had very sharp pain, and this man had only experienced a full feeling. Dr. Crosse considered that myringotomy was one

of the first essentials if there was any bulging of the drum at all, so that the antrum would drain. In continued and increasing pain, even if there were no bulging, myringotomy was indicated. Practically all the children seen with mastoiditis had adenoids. He always removed the adenoids, if any were present, when performing mastoidectomy. This facilitated the drainage from the middle ear. Dr. Crosse never used peroxide of hydrogen in the early stages, but always used the wick treatment; perhaps later he might use peroxide of hydrogen or irrigations.

Dr. Crosse agreed with Dr. Gibson that politization was the only method to be used in children; in adults he preferred catheterization. He stressed the importance of catheterization to clear out residual discharge *et cetera* in *otitis media*, if done very gently after the acute symptoms had subsided somewhat, it did not irritate.

In reply to Dr. Meade, Dr. Crosse said that early examination of the ears in febrile children should always be made. It accounted for the rareness of mastoiditis at the Hospital for Sick Children. He gave Dr. Leckie the credit for instituting the practice of examining the ears in febrile children at that hospital, thus lessening the number of complications.

In reply to Dr. McDonald, Dr. Crosse said that he left his mastoid dressings for six or seven days, providing the temperature was normal. By this time the gauze had become well saturated with serum and was more easily removed. The first dressing was usually carried out under light ethyl chloride anaesthesia. When packing the mastoid he always "pleated" the gauze in; before removal it was sometimes moistened with peroxide of hydrogen. He used worsted strands in radical mastoid operations when skin grafting was carried out. This was a practice carried out in Edinburgh. He was commencing to use antiviral preparations.

In reply to Dr. Geaney, Dr. Crosse said that, according to McKenzie's book, the mastoid cells did communicate with each other by very tiny channels. This appeared to be correct, as the cells became infected so early.

Dr. Crosse had never seen a mastoid infected with the *Streptococcus mucosus*. Pneumococcal infections did not as a rule go on to a mastoiditis, streptococcal infections did.

In reply to Dr. Horn, Dr. Crosse said that in influenzal infections, when residual deafness *et cetera* were left, inflation must be practised early to save the ears.

## Public Health.

### AERIAL MEDICAL SERVICE.

THE following article has been forwarded by the Reverend John Flynn and Dr. G. Simpson. It should be read in conjunction with the leading article appearing in this issue.

THE MEDICAL JOURNAL OF AUSTRALIA, November 12, 1927, published an article on medical services in inland Australia, dealing with the experimental aerial medical service proposed by the Australian Inland Mission—the Bush Department of the Presbyterian Church.

This service commenced in May, 1928, and, from the very outset, won enthusiastic support from friends near and far.

In May, 1929, the Australian Inland Mission Superintendent, the Reverend John Flynn, reported on the work to the First International Health Aviation Conference, which met in Paris, and there he compared notes with delegates from many countries in Europe, Asia and America.

"Flynn of the Inland", a book recently published by Ion Idriess, tells in a fascinating manner the general story of the development of the scheme from a laughed-at dream to an established reality.

As a foundation for the service the Australian Inland Mission commenced experiments in wireless as far back as 1925. After much patient research and field trials,

involving an expenditure of over £5,000, a wireless system has been built up around the Aerial Medical Service Radio Base at Cloncurry, North-West Queensland.

In this system a small portable "pedal" transmitter is the essential unit for all outposts. This set is energized by a generator worked with the operator's feet; hence the name. From the powerful "mother" plant at the base Mr. M. Anderson, Staff Operator for the Aerial Medical Service, transmits messages to twenty outstations, the most distant of which are Hermansburg, Central Australia, and Innamincka, South Australia, both over five hundred miles away. The plants at the outstations are operated by residents (frequently women), who have, in almost every case, been dependent on the travelling radio expert of the Australian Inland Mission for their wireless education. They transmit their inward radiograms in Morse, using an ordinary key; but, in the near future, they will use an automatic key, designed and manufactured specially for their benefit.

This new boon has a special keyboard, which is the facsimile of that of a typewriter. The operator will merely press down the particular letter or sign desired, and the machine will automatically respond by sending perfect Morse signals over the air to the listening operator at Cloncurry. It is estimated that this automatic transmission, which insures both accuracy and speed, will enable the radio base to handle four times as many outstations as at present.

The manufactured cost of the complete transmitter is under £75. The intrinsic upkeep is under £5 *per annum*, but there is also very heavy expense for "service", which has not been charged against the outposts. This service includes, besides the maintenance of the radio base (including staff) at Cloncurry, provision for the Chief Radio Officer, who accompanies the Australian Inland Mission padres on their vast patrols.

In order to keep the amateur operators of the outposts in good form, the Aerial Medical Service radio service handles all kinds of "everyday" messages as well as calls for medical aid. Last year three thousand radiograms were handled in this way.

Under a strict timetable each outpost is "worked" daily in the ordinary way, but, in addition, emergency calls can be put through any day at 12 noon and 5 p.m. Additional times are specially arranged, when necessary. Thus it is possible and easy to call for medical aid from places which previously had been up to three hundred miles distant from the nearest telegraph station or telephone.

It was the early success of these wireless experiments which led the General Assembly of Australia, in 1927, to give authority to the Australian Inland Mission Board to begin an experiment with one Aerial Medical Service station, to be conducted for one year. A stipulation was made that £7,000 must be available before active operations commenced.

Toward the experiment the H. V. McKay Charitable Trust made a special grant of £2,000 and the Wool Brokers' Association provided £1,000. The Commonwealth Government provided a subsidy of one shilling for each mile flown. About two hundred enthusiasts came forward to provide the balance of the £7,000 required.

Meanwhile, a preliminary investigation of the Gulf country had been carried out by the Chief Honorary Medical Adviser of the Australian Inland Mission, Dr. G. Simpson, who interviewed most of the medical practitioners within the district, as reported in the previous article published in this journal.

An Advisory Committee was formed in Melbourne; to it the Victorian Branch of the British Medical Association was asked to nominate a member. Dr. Dunbar Hooper was nominated and has been an active member of the Committee ever since. The Advisory Committee has kept closely in touch with British Medical Association opinion, and the experiment has been developed in complete harmony with existing medical services.

A contract was arranged with "QANTAS" (Queensland and Northern Territory Aerial Services, Limited), under which is maintained, always available at Cloncurry, a D.H.50 aeroplane, "Victory", with a pilot always in charge,



fitted with a stretcher, providing accommodation for doctor, nurse and one patient.

Medical service to be rendered by the Flying Doctor was: (a) By attending accident and other urgent cases, rendering first aid on the spot and, if advisable, transporting patients by air to the nearest suitable hospital, where they would be transferred to the care of the local medical staff; (b) if desired, assisting in consultations with isolated local doctors.

It was provided that the service would be available to all, irrespective of creed or financial position.

From the outset it was understood that, in due course, schemes would be devised whereby local contributions might be stimulated, always without prejudice to the financing of local hospitals and motor ambulances.

The terms of appointment for the doctor provided a salary of £1,000 *per annum*, without board, a life insurance "cover" of £2,000, and travelling expenses and board when away from the base. Private practice was not to be permitted.

In response to an advertisement in THE MEDICAL JOURNAL OF AUSTRALIA in December, 1927, twenty-one applications were received. Dr. K. St. Vincent Welch was appointed. He was entertained by members of the profession in Melbourne, Sydney and Brisbane, evidence that the profession was wholeheartedly behind the scheme and approved of its principles. In May, 1928, Dr. Welch reached Cloncurry by air and was immediately hastened from the aerodrome direct to the hospital to assist in an operation. During his year of service Dr. Welch made fifty flights and covered twenty thousand miles without mishap. Two hundred and fifty-five patients were seen, forty-two in consultation with other doctors; twenty-six centres were visited. The average cost of each flight was nearly £80.

A circular sent throughout the flying area by the British Medical Association provided replies in which all doctors within the area commended the scheme and claimed benefit from it. Dr. Welch was particularly careful not to trespass on the practice of any established practitioner. He refused to see patients in Cloncurry, except in consultation with the local doctor and at his request. He did not visit any outlying centres where there was a doctor, except at the latter's request.

A valuable report which was furnished by Dr. Welch toward the completion of his term, was supplemented by a report of the Australian Inland Mission Superintendent. These reports were considered by the Melbourne Advisory Committee, which adopted the following findings:

1. Air transport for the sick: Throughout the greater part of the year, and over the greater part of the district, aerial transport had been proved invaluable for the sick.

2. Medical care during transport: It is desirable that, ordinarily, a doctor should first examine each patient and decide whether transport is desirable and safe; also, in serious cases, it seemed advisable that the doctor should accompany the patient to guard against possible "reactions" during the journey.

The Committee recommended to the Board of the Australian Inland Mission that the Aerial Medical Service experiment should be continued for at least another year; that steps should be taken to provide more active hospital practice for the Flying Doctor; that steps should be taken with a view to definite coordination of all frontier medical services; and that inquiries should be prosecuted regarding the proposal for the establishment of "travelling fellowships", under which flying doctors might enjoy the advantages of post-graduate study on the completion of their service in isolated areas.

An anonymous gift of £1,000, made just about this time, encouraged the Australian Inland Mission Board to proceed with the second year. Dr. Spalding was appointed and relieved Dr. Welch in May, 1929. He was urged to undertake private practice in Cloncurry. The British Medical Association considered this inadvisable, and the original decision against the right of private practice was confirmed.

Dr. Spalding estimated that 45% of the calls were for urgent medical assistance, usually requiring transport

to hospital; 22% for consultation with outpost doctors or for anæsthetic or surgical assistance; 18% were ambulance trips, at the request of the local doctors, to transport patients from outlying hospitals to Cloncurry. The mileage covered was over 20,000. Dr. Spalding was appointed Honorary Medical Officer at Cloncurry Hospital and assisted the Resident Medical Officer there. He visited the institution three times a week, gave forty anæsthetics and performed twenty major and thirty minor operations. He saw many cases in consultation with the resident doctor. At the conclusion of his term Dr. Spalding reported to the Advisory Committee that local feeling was definitely increasing in favour of a permanent aerial medical service and that the "feeling of security" was definitely appreciated; also that local doctors were not antagonistic.

In order to provide a period for consultation with the local people, Dr. A. May was appointed for six months. Meantime, the Australian Inland Mission Superintendent again visited the district, which he covered almost completely in successive flights, including one to Birdsville, four hundred miles south. Public meetings were held in all the important centres. A conference representative of the Cloncurry district placed on record their appreciation of the Aerial Medical Service, including the comment:

Notes with satisfaction that the work was carried out in complete harmony with all existing medical services.

At Normanton a representative meeting placed on record its "grateful appreciation of benefits rendered to the District Hospital through the experimental service" and registered its conviction "in the light of two and a half years' experience of the assistance rendered, that such an institution is absolutely necessary as a permanent factor in the Gulf area". Similar resolutions were passed by representative meetings at Burketown, Boulia, Kynuna, Camooweal, McKinlay and Birdsville.

Encouraged by the evidence thus secured, the Advisory Committee recommended continuance. Accordingly, the General Assembly of Australia, which met in Sydney in September, 1930, empowered the Australian Inland Mission Board to appeal for funds to establish a permanent aerial medical service with such modifications as might be necessary to meet changing circumstances, and to endeavour to coordinate both medical and wireless work with kindred activities within the area.

In conference with the Advisory Committee in Melbourne, a draft scheme for a permanent service was drawn up and was submitted to the Federal Committee of the British Medical Association, which signified its approval.

After Dr. May returned south, Dr. Cornford, who had previously been in Normanton, carried on the work until the arrival of Dr. Allan Vickers in March, 1931. Unfortunately, at this stage, when so many difficulties had been overcome and all parties seemed favourable towards a permanent service and extension of the scheme to other areas, the full effect of depression became evident. The Federal Government's subsidy was withdrawn and private contributions slackened sadly.

Fortunately, at this stage the Chief Medical Adviser of the Australian Inland Mission (Dr. Simpson) was able to visit the area a second time. He made a careful study of affairs and conferred with the local people. On his return, he reported to the Australian Inland Mission Board:

The Aerial Medical Service has fulfilled, from its inception, all that the promoters originally expected of it; it is now recognized as an essential service by the people. A mantle of safety has been spread by the wings of the "Victory", and home life is being made possible where never before.

Dr. Vickers is helping greatly to coordinate kindred services. Ideals of the permanent service are gradually being established and recognized. The Flying Doctor has been accepted as Medical Officer of Burketown and Kynuna Hospitals. These institutions previously had resident doctors, but, owing to financial difficulties, could not continue the appointments.

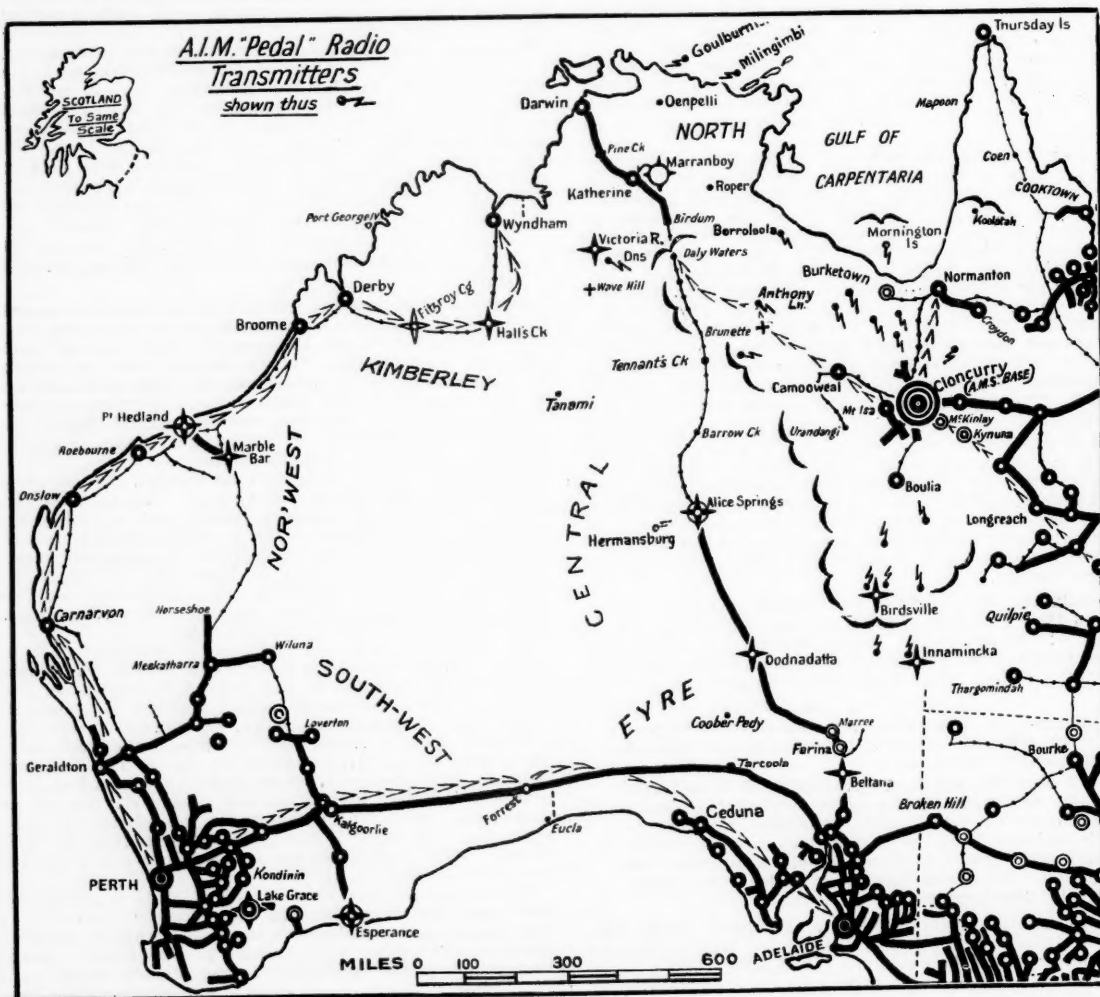
This last arrangement was recognized by the Queensland Government in a practical manner. Ordinarily, where there is no resident doctor on the staff, a bush hospital in Queensland receives a subsidy (as recently reduced) of

fifteen shillings per one pound raised locally. In the case of the above two hospitals, however, the Government continues to pay thirty-five shillings per one pound raised locally, on the understanding that not less than the extra subsidy paid by the Government is passed on to the Aerial Medical Service.

Meantime, Aerial Medical Service Advisory Committees had been constituted in Brisbane and in Sydney. While returning from the north, Dr. Simpson conferred with these committees and arranged for due coordination between them and the original Advisory Committee in

local committees, keen and active, steady continuation of calls (many by wireless) from isolated areas (the average is one such flight per week), and numerous calls for advice, given by the doctor, by wireless telephony from the base.

The Australian Inland Mission Board has ever been grateful to the medical profession for ready help in the establishment and carrying on of the Aerial Medical Service. Its sincere hope is that continued interest and support will enable that "mantle of safety" to be spread over all the frontier areas of Australia.



The present limits of the Aerial Medical Service, which has its base at Cloncurry, are indicated by wings. The district thus "protected" is greater in area than New South Wales. Nursing homes established by the Australian Inland Mission are indicated by stars. Outlying towns where there are resident medical practitioners, usually associated with public hospitals, are indicated by black circles with white centres, bush nursing centres *et cetera*, by concentric circles.

Melbourne, in ardent cooperation with the Australian Inland Mission Board.

In spite of the difficulties of the times, many persons have been inspired to contribute. The Queensland Government, in addition to the sectional subsidies noted above, has provided a grant of £800 for the current year.

Now that the service can be regarded as potentially a permanent one, the local people, in spite of the hardships they are undergoing, have taken fresh heart. Dr. Vickers's term has thus been noted for improvement in local contributions toward financing the scheme, organization of

The region served from the base already established at Cloncurry consists of the Gulf district of Queensland and country southward, together with adjacent portions of North and Central Australia, that is, over three hundred miles north-east, four hundred miles south, and five hundred and fifty miles north-west—the whole equal in area to the State of New South Wales. Regions beyond, where the pioneers are still waiting, are:

1. "North": The outlying areas of North Australia.
2. "Kimberley": The hinterlands of Derby and Wyndham, Western Australia, and the Hall's Creek-Tanami

districts; the western section of North Australia, including Victoria River Downs and Wave Hill, might be included with this area.

3. "North-West": The wide spaces lying between Port Hedland, Wiluna and Carnarvon.

4. "South-West": Fringes of settlement within three hundred miles radius of Kalgoorlie and across to Eucla.

5. "Eyre": The light pastoral lands that stretch far and wide from Lake Eyre to Innamincka and Birdsville, on the Queensland border, and westward again to Eucla.

6. "Centre": All Central Australia for three hundred miles radius around Alice Springs.<sup>1</sup>

## University Intelligence.

### THE UNIVERSITY OF SYDNEY.

A MEETING of the Senate of the University of Sydney was held on August 8, 1932.

The following degrees were conferred *in absentia*:

*Bachelor of Surgery (B.S.)*: Stanley Devenish Meares, M.B.

*Master of Surgery (Ch.M.)*: George Henry Hewitt, M.B., and Charles F. A. de Monchaux, M.B.

The Diploma in Psychiatry was awarded to John A. H. McGeorge, M.B., Ch.M., Garnet Andrew Ross, M.B., and Horace Layton Spearman, M.B., Ch.M.

The resignation of Acting Professor Raymond Firth of his position as Lecturer in Anthropology, as from December 9 next, was received and accepted with regret.

A suggestion from the Musical Association of New South Wales that consideration be given to the possibility of establishing a chair of music or a lectureship in music, and the inclusion of music as a qualifying course in Arts, was referred to the Faculty of Arts for report.

The Royal Commissioners of the Exhibition of 1851 advised that an award of a Science Research Scholarship had been made to Miss Thelma Reynolds, M.Sc.

Permission was given for the holding of examinations for the Diplomas in Public Health and Tropical Hygiene during the August vacation.

A cheque for £1,000 was received from the trustees of the estate of the late Lucien Henry as a bequest for research work in tuberculosis.

The following appointments were approved: Miss Freda Faran, M.A., as Demonstrator in Psychology; Miss Muriel Holdsworth, M.Sc., as Demonstrator in Organic Chemistry; Dr. Keith Barry as Lecturer under the University Extension Board.

The conditions of award of the Marion Clare Reddall Scholarship were amended to read as follows:

(a) The scholarship shall be awarded by the Senate on the recommendation of the Faculty of Medicine for research in any branch of medical science.

(b) The scholarship shall be open to any graduate of the University of Sydney.

(c) During his tenure of the scholarship the holder shall prosecute his researches in some place approved by the Faculty of Medicine.

(d) The tenure of the scholarship shall be for one year, but it may, at the discretion of the Senate, be renewed for one or more years.

(e) At the discretion of the Faculty of Medicine, and with the approval of the Chancellor, the award of the scholarship may be withheld and the interest allowed to accumulate in order that a larger sum may be available for subsequent years.

(f) Applications for the scholarship shall be in the hands of the Registrar by March 1.

(Subject to incorporation of the regulation providing for research fellows and scholars combining teaching with research.)

Conditions under which grants are made from the Hebden Research Fund were amended by the addition of the following paragraph:

Both graduates and undergraduates are eligible to receive grants from the Fund for research as may be approved by the Professors of the Medical School acting as a committee. All applications in connexion with this Fund shall be lodged with the Registrar. The annual sum available from the Hebden Fund does not at present exceed £350.

(Subject to incorporation of the regulation providing for research fellows and scholars combining teaching with research.)

## Correspondence.

### "AVERTIN."

SIR: In assessing the value of a new drug or a new therapeutic procedure, one must be guided by the recorded experiences of others, *plus* one's own experience. Sweeping statements unsupported by facts and details, "whispers" and "warnings", also unsupported by detailed statements, succeed in clouding the issue only.

"Avertin" was placed on the market as a drug for use prior to the administration of a general anaesthetic—essentially a premedicament. Extraordinary precautions were taken to insure that this drug, in the form of "Avertin fluid", was safe. Many successful cases have been reported, and many anaesthetists have commented upon the great advantages "Avertin" possesses as a drug for administration prior to a general anaesthetic, and also upon the fact that its administration is devoid of undue danger.

Then came the "whisperers". "Avertin" caused sloughing of the rectum. I have seen patients refuse "Avertin" because of this bogey, imparted to them by their own medical adviser, who alone knows on what grounds.

Recently a letter appeared in THE MEDICAL JOURNAL OF AUSTRALIA insinuating that "Avertin" was the cause of pneumonia in four cases of operation upon the upper abdomen. It now transpires that this conclusion was quite unwarranted (see article by Dr. H. C. R. Darling on "Post-Operative Pneumonia", THE MEDICAL JOURNAL OF AUSTRALIA, July 23, 1932). And so on. If any worker has found any evil results arising from the use of "Avertin", let him come forward and state what he has discovered, supporting his contentions with detailed evidence, as is done in any discussion worthy to be classified as scientific.

"Whispers" carry no weight, but they do influence the minds of those who pay undue respect to the printed word. The same writer, in the same letter, failed to find one single advantage in "Avertin". He appears to be singularly unobservant. He certainly has not questioned those patients who have had general anaesthetics without "Avertin" premedication and have then had an anaesthetic with "Avertin" premedication. Their opinion is unanimously in favour of "Avertin".

The journal itself issued a "warning" concerning the use of "Avertin" and made certain statements. The warning was justified. It would have been justified also if it had applied to chloroform, but the "warning" lost a lot of its value because it was a mere bald statement.

Was morphine used? What dose was given? Were any of the recognized contraindications present? "Whispers" are valueless in discussions which endeavour to assist in assessing the true value of drugs or scientific procedures.

I, like a lot of other men who administer anaesthetics, have had sufficient personal experience of the use of "Avertin" to know that as a premedication it possesses advantages to the patient, the surgeon and the anaesthetist, that constitute a very valuable advance in the science of anaesthesia.

The patients (ninety in number), the nursing staffs and the surgeons whom I have questioned, agree on this aspect of the discussion.

Dr. Douglas Miller says, in writing of "Avertin": "Nor have the after-effects been happy."

<sup>1</sup>Copies of the map showing the activities of the Aerial Medical Service may be obtained from the office of the Australian Inland Mission, Sydney.



Flatly, my experience has been the opposite to that of Dr. Miller. With basal doses of "Avertin" the time of recovery is longer than is the case with ether and chloroform, but this is so in a minority of cases only. My experience has been that the increased period of unconsciousness, in any case, is so small that it cannot outweigh the other advantages of "Avertin".

Dr. Miller's experiences of "Avertin" described in the first part of his letter were described by Dr. Maddox in his book, and were mine when I first used the drug. The patient does not move with the skin incision now, and my patients are not too deep. The surgeons should not blame the drug for the inexperience of the anaesthetist, and all anaesthetists are inexperienced when they use a new procedure for the first time.

Dr. Miller says: "Surely there are others... safer to use." That is the point. If it could be shown to me that "Avertin" is not safe, I would discard it tomorrow. I have read statements such as those of Dr. Miller and Dr. Kinsella on several occasions, but they have been statements only. If Dr. Miller knows anything, please let him tell it, and so contribute something worth while to this discussion.

On the other hand, records of 150 cases (Dr. Coghlan), 200 in Newcastle district, 100 from Western Australia, and over 200 from Victoria—600 in all—successful administrations without accidents and with favourable comments from the anaesthetists have been published in THE MEDICAL JOURNAL OF AUSTRALIA alone. Eminent surgeons and anaesthetists in England have published most favourable statements concerning its advantages and safety.

Chloroform is dangerous, so is ether. "Avertin" is just as dangerous if it is not administered correctly. From the very first case the question asked by all and sundry was: "Did you use any ether?" A wrong conception of the use of the drug entirely.

My experience of "Avertin" covers ninety unselected cases. Morphine has been used in some cases, but more recently it has not been used, for two reasons: (i) added safety, (ii) results satisfactory without it.

Basal doses have been used in all cases and smaller doses have been given if there was any doubt concerning the suitability of the case for "Avertin". Glucose is always given prior to all anaesthetics: six lumps of loaf sugar in a glass of water on three occasions during the twenty-four hours prior to the operation.

I have not had one moment's anxiety in any of these cases, and as will be seen below, they were not all simple, straightforward, good anaesthetic "risks".

For the benefit of your correspondent, who can see no good in "Avertin", I append a list of the advantages observed. Three colleagues in this district use "Avertin". Well over 200 administrations have been made in Newcastle. My colleagues' experiences with "Avertin" have been similar to mine. All the surgeons for whom I have administered "Avertin" corroborate the statements contained in this letter.

**Advantages:** (1) Pleasantness of administration for patients. This point is so well recognized and accepted that it need not be elaborated.

(2) Lack of post-operative vomiting. This is no figment of the imagination. In "Avertin" anaesthesia, even when six or eight ounces of ether are used, vomiting is absent or negligible, not always, but in the majority of cases. Many cases do not require more than two to four ounces of ether.

Is this not an advantage in operations for cure of incisional hernia, appendicectomy during pregnancy *et cetera*? Is it not an advantage to the patient himself to be relieved of post-operative vomiting?

(3) Better post-operative condition. Surgeons, sister and anaesthetists are quite satisfied that the majority of cases are not so "knocked out" after "Avertin" anaesthesia as is the case after similar surgical procedures in which ether or chloroform alone has been used. "They 'pick up' quicker", says the sister.

(4) In certain cases my experience has been that "Avertin" anaesthesia was used with perfect safety, when ether and chloroform had been tried and the anaesthetic had to be abandoned. Surgeons have asked for "Avertin"

in other cases because they regarded the case as a bad anaesthetic "risk" with ether and chloroform.

(5) In hyperthyroidism it is the anaesthetic *par excellence*.

This has been my experience. I give it for what it is worth. It is small, but it is based on experience. If anybody has unfavourable results to report, please let us hear them with details, but please let us have no more vague whisperings to terrify the souls of those timid laymen and medical men, who can never overcome the dread of anything new.

I entered this discussion for one purpose only, namely, to ask anybody who has any sound and detailed information that would show the use of "Avertin" in basal and sub-basal doses to be unsafe or disadvantageous, to publish it with full details, as is done in any discussion worthy of the name of even pseudo-scientific.

Yours, etc.,

IDRIS MORGAN.

Newcastle,  
August 1, 1932.

#### POTATOES AND CHRONIC DIARRHOEA.

SIR: With reference to Dr. Allan Walker's article of July 30, 1932. There is an old saying: "Some things are too sacred for jest, and one of them is pitatees". The origin is probably Hibernian.

Matron Macgregor, that very wise nursing sister of Bethesda Hospital, Melbourne, taught me how to treat a chronic diarrhoea—potatoes, and nothing but potatoes, for a fortnight if necessary, potato soup, potatoes with butter or with milk. Every case may not be cured, but don't scoff, and the next case you see and feel sad about, give the harmless vegetable a chance. You will be more than pleased.

Yours, etc.,

J. FORBES MACKENZIE.

61, Collins Street,  
Melbourne,  
August 5, 1932.

#### DIATHERMY OF TONSILS.

SIR: *Re* your leader of August 6, 1932, my contention is that if unskilled people persist in tackling tonsils it were better to have them inefficiently done by diathermy than badly attempted by enucleation. I have no personal knowledge of the cases reported by Dr. Graham Brown, but I understand most of them were still under treatment. The important point to discover is whether the condition was better or worse before diathermy was instituted. This method has been used for at least twenty-one years and I have never heard of a death resulting from it. Whether the profession adopt it or not, it is time something was done to improve the position of tonsil surgery. Could not students be taught the anatomy of the tonsil more thoroughly and how to dissect them out both during their anatomy course and in the *post mortem* room.

Yours, etc.,

W. KENT HUGHES.

Melbourne,  
August 9, 1932.

#### POLIOMYELITIS.

SIR: I have read with interest the articles on poliomyelitis which were published in your journal of June 4. A statement appears in the article by Dr. Steigrad which suggests that he has been misinformed or has not had access to the reports of the work to which he referred. I will be grateful if you would allow me to correct the inaccuracy.

Dr. Steigrad stated that experimental work carried out by Burnet at the Walter and Eliza Hall Institute had

shown that the serum prepared for use in poliomyelitis in Melbourne "was impotent" in neutralizing an American strain of poliomyelitis virus. I would refer him to the reports published in (i) THE MEDICAL JOURNAL OF AUSTRALIA, December 12, 1929, page 851 (Burnet, F. M., and Macnamara, J.: "The Activity of Stored Antipoliomyelitic Serum in Experimental Poliomyelitis"); (ii) *The British Journal of Experimental Pathology*, Volume XII, 1931, page 57 (Burnet, F. M., and Macnamara, J.: "Immunological Differences between Strains of Poliomyelitis Virus").

The facts are as follows. When experimental work to ascertain the potency of stored human immune serum was undertaken by Dr. Burnet and myself, we obtained, through the courtesy of Dr. Flexner, virus which had been adapted to the monkey by passages over many years. It was found that the human immune serum, prepared for the Melbourne organization, was equally potent in inactivating either strain and retained its potency for at least three years at ice-box temperature. In the course of this work, a monkey, paralysed by injection of the Victorian virus in March, 1929, developed further paralysis and died, after inoculation in July, 1929, with a filtrate of the Rockefeller virus. This procedure was repeated by another monkey paralysed in February, 1930, with Victorian virus. In August, 1930, the sequence occurred again, when the monkey on the second inoculation developed tremor and excitability, but no further paralysis. The serum of this monkey, withdrawn after his paralysis had been induced by inoculation of the Victorian virus, but before his inoculation with Rockefeller virus, inactivated *in vitro* a suspension of the Victorian virus, but did not modify the infectivity of a filtrate of Rockefeller virus. The reverse procedure, infection by the Victorian virus, of a monkey who had been paralysed two months previously by a partially neutralized Rockefeller virus, resulted in complete paralysis after the usual period of incubation. These results suggested the presence of immunological differences between the American virus and the strain obtained from a child dying in Melbourne in 1928. In America, at present, further work is being done with the Australian strain. The earlier work had shown that pooled human immune serum obtained and prepared in Victoria was equally effective against either strain. In 1930, when a specimen of the serum, prepared in Sydney by the Poliomyelitis Committee of New South Wales, was sent to Dr. Burnet for testing, the specimen sent failed to neutralize the American virus, while effective in inactivating the Victorian strain. Unfortunately, the number of monkeys available was not sufficient to carry these tests further; for the results raised the question: if more than one strain of virus exists, did the fact that the pooled serum obtained in Melbourne neutralized two strains, while that from Sydney neutralized one, result from the fact that up to the time of preparation of the specimens of sera tested, the incidence of poliomyelitis in Victoria had been much higher than in New South Wales?

May I take this opportunity of confirming the principles for treatment of paralysis laid down in the articles of Mr. Vance and Mr. Hembrow? The more one sees of the results of various methods of treating paralysed cases, the more one appreciates the value of patient, detail-perfect application of the principles of complete relaxation of paralysed muscles and prolonged protection from fatigue—principles which were established years ago by Robert Jones and Robert Lovett.

Yours, etc.,

JEAN MACNAMARA.

Toronto,  
Canada,  
July 13, 1932.

SIR: In a previous issue I reported the case of a boy aged five years exhibiting the following symptoms and signs: Severe headache, irritability, drowsiness, marked "spine sign", raised temperature and pulse, early paralysis, but no increased cell content of the cerebro-spinal fluid. Convalescent anterior poliomyelitis serum was given within twelve hours of the onset of paralysis, which disappeared thirty-six hours later.

Commenting on this case in your last issue, Dr. Karen Helms, of the Infantile Paralysis Committee, states that she would not have administered serum in this instance, her reason apparently being that the cerebro-spinal fluid was normal and that paralysis had begun.

I would like to refer Dr. Helms to a very interesting report which appeared in your journal some time ago, by Dr. Steigrad. In this, ninety cases of infantile paralysis occurring in the recent epidemic are discussed. Dr. Steigrad states that eight of these, that is, 9%, showed less than 4% of cells in the cerebro-spinal fluid.

Even assuming that Dr. Helms is right and that paralysis was not present (though I examined this patient scores of times and only during the period mentioned above did I note this condition) or that paralysis was due to some cause other than anterior poliomyelitis, the administration of serum was, I think, distinctly indicated.

If we agree with Dr. Helms that the presence of a normal cerebro-spinal fluid is a contraindication, 9% of Dr. Steigrad's cases would have been deprived of serum and eight more cripples would have resulted from this tragic disease.

It appears to me that this test of the cerebro-spinal fluid is similar to the Wassermann blood test in syphilis and the complement deviation test in gonorrhoea. It is the reaction of certain processes of the body to a specific stimulus, and where for some reason the reaction is not typical, the test remains normal. No one, for example, would say that a patient showing Argyll-Robertson pupils, girde pains, absent knee jerks and a positive Romberg's sign, might not have syphilis because his Wassermann was "negative".

As regards Dr. Helms's statement that we "cannot restore the function of anterior horn cells once this has been lost", I must again disagree. If the loss of function is due to destruction of the cells, then, of course, there can be no recovery, but it is quite possible for this loss of function to result from other causes, such as, for example, pressure in the vicinity of the cells. No one who has ever observed a case of infantile paralysis for a period of several months following the beginning of infection can have failed to notice the marked recovery which takes place in the paralysed muscles. If we accept the modern theory that "early paresis is caused by lymphatic congestion in the cord, and recoveries are due to the removal of the pressure from the spaces", the possibility of the improvement caused by serum, such as in the case I reported, is quite obvious.

Although I appreciate the difficulties of the Infantile Paralysis Committee in obtaining serum, I think they would do more good by attempting to make more serum available than by discouraging its use in suspicious cases.

Yours, etc.,

S. GOLDBERG, M.B., Ch.M.

Banna Avenue,  
Griffith,  
New South Wales,  
August 13, 1932.

#### NOTICE.

THE Editor would be glad to receive from readers copies of THE MEDICAL JOURNAL OF AUSTRALIA for June 20 and July 27, 1931. They are urgently needed at the office.

#### AN EXPEDITION TO THE GREAT BARRIER REEF.

For several years expeditions have been arranged to the Great Barrier Reef by Mr. F. E. Pollock, F.R.G.S. The expeditions are made during the Christmas holidays. Mr. Pollock has arranged an expedition which will leave Mackay, Queensland, on December 22, 1932. On this occasion the Cumberland and Whitsunday Islands will be visited. No previous excursion has been arranged to the South-East Cumberland Islands. The expedition will end at Bowen on January 18, 1933. Men and women devoted to

nature study will find in this excursion much interest and will have opportunities for relaxation and enjoyment. Further particulars may be obtained from Mr. F. E. Pollock, 7, Carrington Avenue, Strathfield, New South Wales.

### Obituary.

#### LESLIE JAMES LAMROCK.

We regret to announce the death of Dr. Leslie James Lamrock, which occurred on August 21, 1932, at Sydney, New South Wales.

### Corrigendum.

In an article on the treatment of peptic ulcer published as "Current Comment" on August 6, 1932, an error was made in the discussion of the findings of Rivers, Vanzant and Essex. The amount 700 grammes of histamine should be 700 milligrammes.

### Books Received.

**INDIVIDUALITY OF THE BLOOD IN BIOLOGY AND IN CLINICAL AND FORENSIC MEDICINE**, by L. Lattes, translated by L. W. Bertie, M.A., B.M., B.Ch.; 1932. London: Oxford University Press (Humphrey Milford). Demy 8vo., pp. 427. Price: 30s. net.

**SURGICAL NURSING AND AFTER-TREATMENT**, by H. C. Rutherford Darling, M.D., M.S., F.R.C.S.; Fourth Edition; 1932. London: J. & A. Churchill. Crown 8vo., pp. 700, with illustrations.

**A NEW DICTIONARY FOR NURSES**, by Lois Oakes, S.R.N., D.N.; 1932. Edinburgh: E. & S. Livingstone. Demy 18mo., pp. 362, with illustrations. Price 3s. net.

**BIOLOGY FOR MEDICAL STUDENTS**, by C. C. Hentschel, M.Sc., and W. R. Ivelmey Cook, B.Sc., Ph.D., with Foreword by G. E. Gask, C.M.G., D.S.O., F.R.C.S.; 1932. London: Longmans, Green and Company. Demy 8vo., pp. 630, with illustrations. Price: 18s. net.

**LANG'S GERMAN-ENGLISH MEDICAL DICTIONARY**, revised and edited by Milton K. Meyers, M.D.; Fourth Edition; 1932. Philadelphia: P. Blakiston's Son and Company, Inc. Medium 8vo., pp. 934.

**SOME FACTORS IN THE LOCALISATION OF DISEASE IN THE BODY**, by Harold Burrows, C.B.E., F.R.C.S.; 1932. London: Baillière, Tindall and Cox. Med. 8vo., pp. 311, with eight illustrations. Price: 15s. net.

### Diary for the Month.

- SEPT. 1.—South Australian Branch, B.M.A.: Council.  
 SEPT. 2.—Queensland Branch, B.M.A.: Branch.  
 SEPT. 5.—New South Wales Branch, B.M.A.: Organization and Science Committee.  
 SEPT. 7.—Victorian Branch, B.M.A.: Branch.  
 SEPT. 7.—Western Australian Branch, B.M.A.: Council.  
 SEPT. 8.—New South Wales Branch, B.M.A.: Clinical Meeting.  
 SEPT. 9.—Queensland Branch, B.M.A.: Council.  
 SEPT. 13.—New South Wales Branch, B.M.A.: Ethics Committee.  
 SEPT. 20.—New South Wales Branch, B.M.A.: Executive and Finance Committee.  
 SEPT. 21.—Western Australian Branch, B.M.A.: Branch.  
 SEPT. 23.—Queensland Branch, B.M.A.: Council.  
 SEPT. 27.—New South Wales Branch, B.M.A.: Medical Politics Committee.  
 SEPT. 28.—Victorian Branch, B.M.A.: Council.  
 SEPT. 29.—South Australian Branch, B.M.A.: Branch.  
 SEPT. 29.—New South Wales Branch, B.M.A.: Branch.

### Medical Appointments.

Dr. S. H. Hankins (B.M.A.) has been appointed Government Medical Officer at Collarenebri, New South Wales.

Dr. J. C. Bennett (B.M.A.) has been appointed Medical Officer of Health to the Claremont Road Board, Western Australia.

### Medical Appointments: Important Notice.

MEDICAL practitioners are requested not to apply for any appointment referred to in the following table, without having first communicated with the Honorary Secretary of the Branch named in the first column, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

BRANCH.	APPOINTMENTS.
NEW SOUTH WALES: Honorary Secretary, 135, Macquarie Street, Sydney.	Australian Natives' Association. Ashfield and District United Friendly Societies' Dispensary. Balmain United Friendly Societies' Dispensary. Friendly Society Lodges at Casino. Leichhardt and Petersham United Friendly Societies' Dispensary. Manchester Unity Medical and Dispensing Institute, Oxford Street, Sydney. North Sydney Friendly Societies' Dispensary Limited. People's Prudential Assurance Company Limited. Phoenix Mutual Provident Society.
VICTORIAN: Honorary Secretary, Medical Society Hall, East Melbourne.	All Institutes or Medical Dispensaries. Australian Prudential Association, Proprietary, Limited. Mutual National Provident Club. National Provident Association. Hospital or other appointments outside Victoria.
QUEENSLAND: Honorary Secretary, B.M.A. Building, Adelaide Street, Brisbane.	Brisbane Associated Friendly Societies' Medical Institute. Mount Isa Mines. Toowoomba Associated Friendly Societies' Medical Institute. Chillagoe Hospital. Members accepting LODGE appointments and those desiring to accept appointments to any COUNTRY HOSPITAL are advised, in their own interests, to submit a copy of their agreement to the Council before signing.
SOUTH AUSTRALIAN: Secretary, 207, North Terrace, Adelaide.	All Lodge Appointments in South Australia. All Contract Practice Appointments in South Australia.
WESTERN AUSTRALIAN: Honorary Secretary, 65, Saint George's Terrace, Perth.	All Contract Practice Appointments in Western Australia.
NEW ZEALAND (Wellington Division): Honorary Secretary, Wellington.	Friendly Society Lodges, Wellington, New Zealand.

### Editorial Notices.

MANUSCRIPTS forwarded to the office of this journal cannot under any circumstances be returned. Original articles forwarded for publication are understood to be offered to THE MEDICAL JOURNAL OF AUSTRALIA alone, unless the contrary be stated.

All communications should be addressed to "The Editor", THE MEDICAL JOURNAL OF AUSTRALIA, The Printing House, Seamer Street, Glebe, New South Wales. (Telephones: MW 2651-2.)

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